

Module Manual

Bachelor of Science

General Engineering Science (English program, 7 semester)

Cohort: Winter Term 2017

Updated: 28th June 2017

Table of Contents

Table of Contents	2
Program description	6
Core qualification	8
Module M0701: Chemistry (GES)	8
Module M0745: Electrical Engineering I	10
Module M1121: Programming in C	12
Module M0736: Linear Algebra Module M1081: Mechanics I (GES)	1 <u>4</u> 16
Module M1061: Mechanics (GES) Module M0577: Nontechnical Complementary Courses for Bachelors	18
Module M1139: Physics for Engineers (GES)	20
Module M0671: Technical Thermodynamics I	22
Module M0772: Electrical Engineering II	24
Module M0737: Mathematical Analysis	26
Module M1103: Mechanics II (GES)	28
Module M1348: Fundamentals of Mechanical Engineering (GES)	30
Module M0688: Technical Thermodynamics II	32
Module M0853: Mathematics III	34
Module M1105: Mechanics III (GES) Module M1273: Advanced Internship GES	37 39
Specialization Civil Engineering	40
Module M0580: Principles of Building Materials and Building Physics	40
Module M0740: Structural Analysis I	42
Module M0590: Building Materials and Building Chemistry	44
Module M0706: Geotechnics I	45
Module M0613: Reinforced Concrete I	47
Module M0744: Structural Analysis II	49
Module M0611: Steel Structures I	51
Module M0728: Hydraulic Engineering I	53
Module M0833: Introduction to Control Systems	55
Module M0628: Water Management	58
Module M0730: Computer Engineering Module M0631: Concrete Structures II	60 62
Module M0755: Geotechnics II	64
Module M0878: Applications in Civil and Environmental Engineering	66
Module M0829: Foundations of Management	74
Module M0579: Structural Design	77
Module M0686: Sanitary Engineering	81
Module M0869: Hydraulic Engineering II	84
Specialization Bioprocess Engineering	86
Module M0886: Fundamentals of Process Engineering	86
Module M0937: Physical Chemistry	88
Module M0730: Computer Engineering	90
Module M0536: Fundamentals of Fluid Mechanics Module M0544: Phase Equilibria Thermodynamics	92 94
Module M0757: Biochemistry and Microbiology	97
Module M0672: Signals and Systems	101
Module M0938: Bioprocess Engineering - Fundamentals	103
Module M0538: Heat and Mass Transfer	105
Module M0546: Thermal Separation Processes	107
Module M0892: Chemical Reaction Engineering	112
Module M0945: Bioprocess Engineering - Advanced	116
Module M0833: Introduction to Control Systems	118
Module M1275: Environmental Technology	121
Module M0539: Process and Plant Engineering I Module M0670: Particle Technology and Solids Process Engineering	123 126
Module M0820: Foundations of Management	128
Module M1274: Environmental Technology	131
Specialization Electrical Engineering	133
Module M0708: Electrical Engineering III: Circuit Theory and Transients	133
Module M0730: Computer Engineering	135
Module M0567: Theoretical Electrical Engineering I: Time-Independent Fields	137
Module M0672: Signals and Systems	140
Module M0748: Materials in Electrical Engineering	142
Module M0709: Electrical Engineering IV: Transmission Lines and Research Seminar	146
Module M0854: Mathematics IV	148
Module M0675: Introduction to Communications and Random Processes Module M0568: Theoretical Electrical Engineering II: Time-Dependent Fields	151
Modulo M1235: Floctrical Power Systems I	153 156
Module M0760: Electronic Devices	159
Module M0783: Measurements: Methods and Data Processing	161
Module M0833: Introduction to Control Systems	163

Module	M0777: Semiconductor Circuit Design	166
	M0829: Foundations of Management	169
	M0734: Electrical Engineering Project Laboratory	172
	ization Energy and Enviromental Engineering	173
	M0730: Computer Engineering	173
Module	M0933: Fundamentals of Materials Science	175
Module	M0598: Mechanical Engineering: Design	177
Module	M0536: Fundamentals of Fluid Mechanics	180
	M0610: Electrical Machines	182
	M0618: Renewables and Energy Systems	184
	M0538: Heat and Mass Transfer	186
	M0546: Thermal Separation Processes	188
Module	M0639: Gas and Steam Power Plants	193
Module	M0956: Measurement Technology for Mechanical and Process Engineers	196
	M1275: Environmental Technology	199
	M0833: Introduction to Control Systems	201
	M0670: Particle Technology and Solids Process Engineering	204
	M1274: Environmental Technology	206
Module	M0891: Informatics for Process Engineers	208
Module	M0539: Process and Plant Engineering I	211
Module	M0829: Foundations of Management	214
	ization Computer Science	217
	M0561: Discrete Algebraic Structures	217
	M0730: Computer Engineering	218
Module	M0553: Objectoriented Programming, Algorithms and Data Structures	220
Module	M0672: Signals and Systems	222
	M0852: Graph Theory and Optimization	224
	M0727: Stochastics	226
	M0624: Automata Theory and Formal Languages	228
	M0803: Embedded Systems	230
	M0662: Numerical Mathematics I	232
Module	M0793: Seminars Computer Science and Mathematics	234
Module	M0834: Computernetworks and Internet Security	236
	M0731: Functional Programming	238
	M0791: Computer Architecture	240
	M0833: Introduction to Control Systems	
		242
	M0562: Computability and Complexity Theory	245
Module	M0829: Foundations of Management	246
Module	M1269: Lab Cyber-Physical Systems	249
Module	M0732: Software Engineering	250
	M0971: Operating Systems	251
	M1062: Mathematical Statistics	252
	ization Mechanical Engineering	254
Module	M0598: Mechanical Engineering: Design	254
Module	M0933: Fundamentals of Materials Science	257
Module	M0680: Fluid Dynamics	259
	M0960: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)	261
	M0956: Measurement Technology for Mechanical and Process Engineers	263
	M0865: Fundamentals of Production and Quality Management	266
	M0610: Electrical Machines	268
	M0934: Advanced Materials	270
Focus B	Biomechanics	272
	M0597: Advanced Mechanical Engineering Design	272
	M1077: MED I: Introduction to Anotomy	275
	M0672: Signals and Systems	277
	M1278: MED I: Introduction to Radiology and Radiation Therapy	279
	M0730: Computer Engineering	281
Module	M1279: MED II: Introduction to Biochemistry and Molecular Biology	283
Module	M0662: Numerical Mathematics I	284
	M0922: Introduction to Control Systems	286
	M1333: BIO I: Implants and Fracture Healing	289
	M1280: MED II: Introduction to Physiology	291
	M0829: Foundations of Management	292
	M1332: BIO I: Experimental Methods in Biomechanics	295
Focus E	nergy Systems	296
	M0730: Computer Engineering	296
	M0670: Signala and Systems	298
	MOSSA: Heat Transfer	300
	M0833: Introduction to Control Systems	302
	M0597: Advanced Mechanical Engineering Design	305
	M0655: Computational Fluid Dynamics I	308
Module	M0639: Gas and Steam Power Plants	310
Module	M1022: Reciprocating Machinery	313
	M0829: Foundations of Management	316
	M0618: Renewables and Energy Systems	319

	Systems Engineering	321
	Advanced Mechanical Engineering Design	321
	Signals and Systems	324
	Advanced Mechanical Design Project Simulation and Design of Mechatronic Systems	326 328
	Introduction to Control Systems	330
	Computer Engineering	333
	Integrated Product Development and Lightweight Design	335
Module M0767:	Aeronautical Systems	337
	Foundations of Management	339
	s in Engineering Sciences	342
	Advanced Mechanical Engineering Design	342 345
	Signals and Systems Structural Materials	345
	Numerical Mathematics I	349
Module M1009:	Material Science Laboratory	351
	Introduction to Control Systems	353
	Computer Engineering	356
	Enhanced Fundamentals of Materials Science Foundations of Management	358 361
Focus Mechatr		364
	Advanced Mechanical Engineering Design	364
	Signals and Systems	367
Module M0708:	Electrical Engineering III: Circuit Theory and Transients	369
	Simulation and Design of Mechatronic Systems	371
	Computer Engineering	373
	Introduction to Control Systems Semiconductor Circuit Design	375 378
	Mathematics IV	381
	Foundations of Management	384
Focus Product	Development and Production	387
	Advanced Mechanical Engineering Design	387
	Production Engineering	390
	Advanced Mechanical Design Project Production Technology	393 395
	Computer Engineering	398
	Introduction to Control Systems	400
Module M0599:	Integrated Product Development and Lightweight Design	403
	Enhanced Fundamentals of Materials Science	405
	Foundations of Management	408
	cal Mechanical Engineering Advanced Mechanical Engineering Design	411
	Signals and Systems	414
	Advanced Mechanical Design Project	416
Module M0684:		418
	Computer Engineering	420
	Introduction to Control Systems	422
	Production Engineering Simulation and Design of Mechatronic Systems	425 428
	Mathematics IV	430
	Foundations of Management	433
Specialization	Biomedical Engineering	436
	Fundamentals of Materials Science	436
	Computer Engineering	438
	Fluid Dynamics Signals and Systems	440 442
	Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)	444
	MED I: Introduction to Anatomy	446
	MED I: Introduction to Radiology and Radiation Therapy	448
	Mechanical Engineering: Design	450
	Numerical Mathematics I	453 455
Module M0684:	Heat Transfer Measurement Technology for Mechanical and Process Engineers	455 457
	Introduction to Control Systems	460
	MED II: Introduction to Biochemistry and Molecular Biology	463
Module M1333:	BIO I: Implants and Fracture Healing	464
	Foundations of Management	466
	Introduction into Medical Technology and Systems MED II: Introduction to Physiology	469 471
	BIO I: Experimental Methods in Biomechanics	471
	Naval Architecture	473
Module M0833:	Introduction to Control Systems	473
	Computer Engineering	476
Module M0829:	Foundations of Management	478

Module M0854: Mathematics IV	481
Module M0960: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)	484
Module M0680: Fluid Dynamics	486
Module M0640: Stochastics and Ship Dynamics	488
Module M0655: Computational Fluid Dynamics I	491
Module M0659: Fundamentals of Ship Structural Design and Analysis	493
Module M0664: Structural Design and Construction of Ships	496
Module M1109: Resistance and Propulsion	498
Module M1118: Hydrostatics and Body Plan	499
Module M0933: Fundamentals of Materials Science	502
Module M1110: Ship Design	504
Specialization Process Engineering	506
Module M0886: Fundamentals of Process Engineering	506
Module M0937: Physical Chemistry	508
Module M0730: Computer Engineering	510
Module M0536: Fundamentals of Fluid Mechanics	512
Module M0544: Phase Equilibria Thermodynamics	514
Module M0672: Signals and Systems	517
Module M0938: Bioprocess Engineering - Fundamentals	519
Module M0538: Heat and Mass Transfer	521
Module M0546: Thermal Separation Processes	523
Module M0892: Chemical Reaction Engineering	528
Module M0956: Measurement Technology for Mechanical and Process Engineers	532
Module M0833: Introduction to Control Systems	535
Module M1275: Environmental Technology	538
Module M0539: Process and Plant Engineering I	540
Module M0670: Particle Technology and Solids Process Engineering	543
Module M0829: Foundations of Management	545
Module M0891: Informatics for Process Engineers	548
Module M1274: Environmental Technology	551
Thesis	553
Module M-001: Bachelor Thesis	553



Program description

Content

The Bachelor-program General Engineering Science (GES) starts with a broad, for all students binding fundamental engineering curricula. With begin of the 3rd Semester students have to choose one of the 9 fields of study (civil engineering, biotechnology, electrical engineering, energy- and environmental engineering, computer science, mechanical engineering, medical engineering, naval engineering, process engineering, some of them with further specialisations. GES has with 210 credit points a higher workload compared to other Bachelor study courses. Therefore General Engineering Science is designed for 7 semesters.

Career prospects

The graduates of the Bachelor program General Engineering Science are directly able to enter a career in the field of mechanical engineering, civil engineering, electrical engineering, process engineering or computer science engineering and work responsibly as engineer. They are entitled to use the professional title Ingenieurin or Ingenieur (Engineer) pursuant to the Engineers Acts (Ingenieurgesetzen) of the states in Germany.

Possible employers include companies in mechanical, civil, process, electrical and computer science engineering as well as engineering firms.

The Bachelor degree in one of the fields of study enables a consecutive study of one of the corresponding Master studies, of another technical or of an economic oriented Master study. Most of the modules in the 1st and the 2nd semester of GES are offered in English.

Learning target

Knowledge

Students can:

- · Name and describe the mathematical and scientific principles and methods of the engineering sciences;
- · Ellucidate the principles and methods of the engineering sciences and present an overview of their subject;
- · Explain in detail the foundations, methods and areas of application of their specialization, and, as necessary, their particular focus;
- Recite the foundations and methods of the engineering sciences and provide an overview of the relevant social, ethical, ecological and economic marginal conditions of their subject.

Skills

Graduates are able to

- · Identify and abstract subject-related problems fundamentally and solve them holistically
- · Identify, combine and apply in an interdisciplinary manner the methods appropriate for the desired analysis, modeling, simulation and optimization
- · Penetrate, analyze and evaluate products and methods from different branches of engineering on a systems technology basis
- Applofdesign methods from different branches of engineering
- · Plan and carry out experiments and interpret the results
- Assess the limits of techniques and methods
- Use their knowledge in an interdisciplinary manner and responsible way, taking economic requirements into consideration
- · Evaluate problems in a wider societal context and assess the non-technical repercussions of engineering

Social Competence

Graduates are able to

- Collaborate with both English and German speaking specialists in other disciplines
- · Present the methods and results of their work comprehensively both orally and in writing
- Communicate with experts and laypersons about the contents and problems of engineering
- · Respond appropriately to inquiries, additions and comments
- · Work in groups, define, allocate and integrate subtasks, reach agreement on schedules and to interact socially.

Autonomy

Graduates are able to

- Familiarize themselves with the relevant literature and effectively use databases and other digital sources of information as well as present the results of their work comprehensively both orally and in writing
- · Assess their existing competences realistically and develop and carry out strategies for compensating any deficits they identify
- · Learn a range of subjects and work independently
- Expand and deepen their understanding through a process of lifelong learning

Program structure

The program is split into the core qualifications, the specialisation qualification and the Bachelor thesis





The internship and the interdisciplinary final thesis is scheduled for the seventh semester.



Core qualification

GES)			
	Тур	Hrs/wk	СР
	Lecture	2	2
	Recitation Section (large)	1	1
	Lecture	2	2
	Recitation Section (large)	1	1
Dr. Christoph Wutz			
None			
None			
After taking part successfully, students have read	ched the following learning results		
The students are able to name and to describe basic principles and applications of general chemistry (structure of matter, periodic table, chemical			
bonds), physical chemistry (aggregate states	, separating processes, thermodynamics, kinetics), i	norganic chemistry (a	cid/base, pH-value, salts,
solubility, redox, metals) and organic chemist	ry (aliphatic hydrocarbons, functional groups, carbon	yl compounds, aromate	es, reaction mechanisms,
natural products, synthetic polymers). Furthermore students are able to explain basic chemical terms.			
After successful completion of this module students are able to describe substance groups and chemical compounds. On this basis, they are canable of			
explaining, choosing and applying specific methods and various reaction mechanisms.			
Students are able to take part in discussions on chemical issues and problems as a member of an interdisciplinary team. They can contribute to those			
discussion by their own statements.			
After successful completion of this module students are able to solve chemical problems independently by defending proposed approaches with			
· ·	·	dently by detending pr	oposed approaches with
arguments. They can also document their approx	aches.		
Independent Study Time 96, Study Time in Lectu	ire 84		
6			
Written exam			
120 min			
General Engineering Science (English program)	: Core qualification: Compulsory		
General Engineering Science (English program,	7 semester): Core qualification: Compulsory		
	The students are able to name and to describ bonds), physical chemistry (aggregate states solubility, redox, metals) and organic chemist natural products, synthetic polymers). Furthermo After successful completion of this module stude explaining, choosing and applying specific meth Students are able to take part in discussions or discussion by their own statements. After successful completion of this module stude arguments. They can also document their approximately independent Study Time 96, Study Time in Lecture 6 Written exam 120 min General Engineering Science (English program)	Typ Lecture Recitation Section (large) Lecture Recitation Section (large) Lecture Recitation Section (large) Dr. Christoph Wutz None After taking part successfully, students have reached the following learning results The students are able to name and to describe basic principles and applications of general chemis bonds), physical chemistry (aggregate states, separating processes, thermodynamics, kinetics), is solubility, redox, metals) and organic chemistry (aliphatic hydrocarbons, functional groups, carbon natural products, synthetic polymers). Furthermore students are able to explain basic chemical terms. After successful completion of this module students are able to describe substance groups and chemic explaining, choosing and applying specific methods and various reaction mechanisms. Students are able to take part in discussions on chemical issues and problems as a member of an int discussion by their own statements. After successful completion of this module students are able to solve chemical problems independents. They can also document their approaches. Independent Study Time 96, Study Time in Lecture 84 6 Written exam	Typ Hrswk Lecture 2 Rectation Section (large) 1 Dr. Christoph Wutz None None After taking part successfully, students have reached the following learning results The students are able to name and to describe basic principles and applications of general chemistry (structure of matter bonds), physical chemistry (aggregate states, separating processes, thermodynamics, kinetics), inorganic chemistry (a solubility, redox, metals) and organic chemistry (alphatic hydrocarbons, functional groups, carbonyl compounds, aromate natural products, synthetic polymers). Furthermore students are able to explain basic chemical terms. After successful completion of this module students are able to describe substance groups and chemical compounds. On this explaining, choosing and applying specific methods and various reaction mechanisms. Students are able to take part in discussions on chemical issues and problems as a member of an interdisciplinary team. The discussion by their own statements. After successful completion of this module students are able to solve chemical problems independently by defending prarguments. They can also document their approaches. Independent Study Time 96, Study Time in Lecture 84 6 Written exam 120 min General Engineering Science (English program): Core qualification: Compulsory

Course L0	Course L0467: Chemistry (GES) I		
Тур	Lecture		
Hrs/wk	2		
CP	2		
Workload	Independent Study Time 32, Study Time in Lecture 28		
in Hours			
Lecturer	Dr. Christoph Wutz		
Language	EN		
Cycle	WiSe		
Content	- Structure of matter		
	- Periodic table		
	- Electronegativity		
	- Chemical bonds		
	- Solid compounds and solutions		
	- Chemistry of water		
	- Chemical reactions and equilibria		
	- Acid-base reactions		
	- Redox reactions		
Literature	- Gallagher, Ingram: Complete Chemistry (Oxford University Press)		
	- Corwin: Introductory Chemistry (Pearson)		
	- Burrows, Parsons, Price, Holman: Chemistry3 (Oxford University Press)		



Course L0478: Chemistry (GES) I		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Christoph Wutz	
Language	EN	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0	Course L0469: Chemistry (GES) II		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload	Independent Study Time 32, Study Time in Lecture 28		
in Hours			
Lecturer	Dr. Christoph Wutz		
Language	EN		
Cycle	rcle WiSe		
Content	nt - Simple compounds of carbon, aliphatic hydrocarbons, aromatic hydrocarbons,		
	- Alkohols, phenols, ether, aldehydes, ketones, carbonic acids, ester, amines, amino acids, fats, sugars		
	- Reaction mechanisms, radical reactions, nucleophilic substitution, elimination reactions, addition reaction		
	- Practical apllications and examples		
Literature	- Gallagher, Ingram: Complete Chemistry (Oxford University Press)		
	- Corwin: Introductory Chemistry (Pearson) - Burrows, Parsons, Price, Holman: Chemistry3 (Oxford University Press)		

Course L0479: Chemistry (GES) II		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Christoph Wutz	
Language	EN	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0745: Electrical E	ngineering I			
Courses				
Title		Тур	Hrs/wk	CP
Electrical Engineering I (L0677)		Lecture	3	5
Electrical Engineering I (L0679)		Recitation Section (small)	2	1
Module Responsible	Prof. Manfred Kasper			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The students know the basic theory, relations and methods of dire	ct current networks and of electric and n	nagnetic fields. This in	cludes especially:
	Kirchhoff's voltage and current laws,			
	Ohm's law,			
	 methods to simplify and analyze direct current networks, 			
	description of electric and magnetic fields by use of vectori	al field quantities.		
	Basic material relations,			
	Gauss's law,			
	Ampère's law,			
	Ampere slaw, induction law.			
	Maxwell's equation in the integral form,			
	concept and definition of resistance, capacitance and inductance.			
	consept and deminion of resistance, supusiance and made	otalise.		
Skills	The students are able to establish relations between currents and voltages in simple direct current networks and to apply these to calculate and			
	dimension networks. Student know to apply the fundamental laws of electric and magnetic fields and are able to derive and evaluate relations between			
	field quantities. Students know to calculate resistance, capacitance	e and inductance of simple geometric a	rrangements.	
Personal Competence				
Social Competence	Students are able to solve specific problems alone or in a group a	and to present the results accordingly S	Students can explain co	oncepts and on the basi
Social Competence	of examples verify and deepen their understanding.	and to prodont the results accordingly.	ALL CONTROL OUT GAPIGITI OF	
	or examples verify and deepen their understanding.			
Autonomy	Students are able to acquire particular knowledge using textbook in a self-learning process, to integrate, present and associate this knowledge with			
	other fields. The students develop perseverance to also solve mor	e complicated problems.		
Workload in House	Independent Chidy Time 110 Chidy Time in Leature 70			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following				
Curricula	General Engineering Science (English program, 7 semester): Cor	e qualification: Compulsory		

Course L0677: Electrical Engineering I			
Тур	Lecture		
Hrs/wk	3		
CP	5		
Workload in Hours	Independent Study Time 108, Study Time in Lecture 42		
Lecturer	Prof. Manfred Kasper		
Language	EN		
Cycle	WiSe		
	1. Basics of Resistive Circuits 2. Simplifying Resistive Circuits 3. Network Analysis 4. The Electrostatic Field 5. Stationary Currents in Conductive Media 6. Electrostatic Field in Non-Conductive Media 7. Static Magnetic Field 8. Induction and Time-Dependent Fields		
Literature	 M. Kasper, Lecture Notes Electrical Engineering Fundamentals 1, 2013 A. R. Hambley: Electrical Engineering, Principles and Applications, Pearson Education, 2008 P. M. Fishbane: Physics for Scientists and Engineers, Prentice Hall, 1996 M. Albach: Grundlagen der Elektrotechnik 1, Pearson Education, 2004 F. Moeller, H. Frohne, K.H. Löcherer, H. Müller: Grundlagen der Elektrotechnik, Teubner, 2005 		



Course L0679: Electrical Engineering I		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Prof. Manfred Kasper	
Language	EN	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



ourses				
le	Тур		Hrs/wk	CP
ogramming in C (L0083) ogramming in C (L1488)	Lecture Laboratory C	Course	1	1
Module Responsible	Prof. Siegfried Rump			
Admission Requirements	None			
Recommended Previous	Elementary PC handling skills			
Knowledge	Elementary mathematical skills			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge	The students know by heart the basic syntax of C programming as well as its meaning, i purpose.	ntent and		
	They know the fundamental components and principles of elementary procedural progra	amming		
	based on C programming and can explain them:			
	basic data types (integers, floating point numbers, characters)			
	advanced data types (pointers, arrays, strings, composed data types, type conversion)			
	operators (arithmetical operations, logical operations, bit operations)			
	control flow (choice, loops, jumps, conditional compilation)			
	functions and macros			
	important standard libraries and functions			
	• recursion			
	linked lists			
	The students are prepared for continuing programming lectures like object oriented programming	gramming in C++.		
Skills	The students know how to use an integrated development environment for C programm	ing on a PC		
	so that they can write, store, compile and execute C programs on it.			
	Using their knowledge they are able to read and understand given C Programs.			
	They can solve simple algorithmic problems on their own and can model and program to in C language.	heir solutions		
	The students are able to solve selected exercises from other areas of their study like ma	thematics,		
	mechanics, electrical engineering or physics with the aid of small C programs/-projects	numerically.		
Barraguel Commetence				
Personal Competence Social Competence	The students are able to work in small teams to solve given weekly tasks, to identify and	analyza		
30ciai competence	programming errors and to present their results.	anaryze		
	They are able to explain simple phenomena to each other directly at the PC.			
Autonomy	The students prepare themselves using the given teaching material and solve the given			
,	programming exercises on their own.			
	Additionally the control of the cont	d also to		
	Additionally, they write small C programs to understand and check addressed issues an	iu aiso to		
	gain a certain programming experience.			
	For details beyond the scope of the lecture the students inform themselves using the sta	ted		
	literature and / or by supplementary own research.			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28			
Credit points	2			
Examination	Homework			
Examination duration and scale	1-2 coding tasks weekly			
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory			
Curricula	General Engineering Science (German program, 7 semester): Core qualification: Comp	ulsory		
	General Engineering Science (English program): Core qualification: Compulsory	-		
	1	ulsory		



Course L0083: Programming in C	
Тур	Lecture
Hrs/wk	f
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Siegfried Rump, Weitere Mitarbeiter
Language	DE/EN
Cycle	WiSe
Content	C-Programming:
	basic data types (integers, floating point numbers, characters, boolean values)
	advanced data types (pointers, arrays, strings, composed data types, type conversion)
	3. operators (arithmetical operations, logical operations, bit operations)
	4. control flow (choice, loops, jumps, conditional compilation) 4. control flow (choice, loops, jumps, conditional compilation)
	5. functions and macros (basic function definitions and calls, program parameters, "call by value" versus "call by reference", storage classes,
	functions with variable many arguments, macros, inline functions, modular design, function pointers)
	6. important standard libraries and functions (stdio.h, stdlib.h, math.h, string.h, ctype.h, time.h)
	7. example programs for technical and mathematical applications
	7. Example programs for teaminal and mainternation approachers
Literature	Kernighan, Brian W (Ritchie, Dennis M.;)
	The C programming language
	ISBN: 9780131103702
	Upper Saddle River, NJ [u.a.]: Prentice Hall PTR, 2009
	Sedgewick, Robert
	Algorithms in C
	ISBN: 0201316633
	Reading, Mass. [u.a.]: Addison-Wesley, 2007
	Kaiser, Ulrich (Kecher, Christoph.;)
	C/C++: Von den Grundlagen zur professionellen Programmierung
	ISBN: 9783898428392
	Bonn : Galileo Press, 2010
	Boilin . Gailleo Fress, 2010
	Wolf, Jürgen
	C von A bis Z : das umfassende Handbuch
	ISBN: 3836214113
	Bonn : Galileo Press, 2009

Course L1488: Programming in C	
Тур	Laboratory Course
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Siegfried Rump, Weitere Mitarbeiter
Language	DE/EN
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Mandala MOZOCalimana Alma	have			
Module M0736: Linear Alge	edra			
Courses				
Title		Тур	Hrs/wk	СР
Linear Algebra (L0642)		Lecture	4	4
Linear Algebra (L0643)		Recitation Section (large)	2	2
Linear Algebra (L0645)		Recitation Section (small)	2	2
Module Responsible	Prof. Marko Lindner			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	Ot death and the back and the b	and the second of the second o	and a fact a second and a second and	
	Students can name the basic concepts in linear algebra. The students can be seen that the second secon			de de cheste et communica
	Students can discuss logical connections between these control of the students and account of the students are students.	oncepts. They are capable of illustrating	inese connections wi	in the help of examples.
	 They know proof strategies and can reproduce them. 			
Skills	Students can model problems in linear algebra with the he	n of the concents studied in this course	Moreover they are ca	nable of solving them by
	applying established methods.		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	pasie er cerving arem sy
	Students are able to discover and verify further logical controls.	nections between the concents studied in	the course	
	For a given problem, the students can develop and execute	· ·		eulte
	- 1 of a given problem, the stadents can develop and excess	a suitable approach, and are able to on	addity evaluate the re	Surio.
Personal Competence				
Social Competence	- Students are able to work together (e.g. on their regular home wo	urk) in hotorogonoously composed to ame	/i o toams from diffo	ront ctudy programs and
30ciai Competence	background knowledge) and to present their results appropriately		(i.e., teams nom une	rent study programs and
	background knowledge) and to present their results appropriately	(e.g. during exercise class).		
Autonomy	- Students are capable of checking their understanding of complex	concepts on their own. They can specify	open questions pred	isely and know where to
	get help in solving them.			
	- Students can put their knowledge in relation to the contents of oth	ner lectures.		
	- Students have developed sufficient persistence to be able to wor	k for longer periods in a goal-oriented ma	nner on hard probler	ns.
Workload in Hours	Independent Study Time 128, Study Time in Lecture 112			
Credit points	Written even			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	Computer Science: Core qualification: Compulsory			
Curricula	General Engineering Science (English program): Core qualificatio			
	General Engineering Science (English program, 7 semester): Core	e qualification: Compulsory		

Course L0642: Linear Algebra	
Тур	Lecture
Hrs/wk	4
CP	4
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56
Lecturer	Dr. Francisco Javier Hoecker-Escuti
Language	EN
Cycle	WiSe
Content	Preliminaries
	Vector spaces Matrices and linear systems of equations
	Scalar products and orthogonality Basis transformation Determinants Eigen values
Literature	Strang: Linear Algebra Beutelsbacher: Lineare Algebra



Course L0643: Linear Algebra	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Francisco Javier Hoecker-Escuti
Language	EN
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0645: Linear Algebra	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Francisco Javier Hoecker-Escuti
Language	EN
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M1081: Mechanics	I (GES)			
Courses				
Title		Тур	Hrs/wk	CP
Mechanics I (GES) (L1373)		Lecture	2	3
Mechanics I (GES) (L1374)		Recitation Section (large)	3	3
Module Responsible	Prof. Radoslaw Iwankiewicz			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following \ensuremath{I}	earning results		
Professional Competence				
Knowledge	The primary purpose of the study of Statics is to develop the cap	pacity to predict the effects of forces o	n rigid bodies, structu	ral elements and simple
	structures, which are at rest (in equilibrium). Such a capacity is crit	cal to the design of many structural or	engineering systems.	The particular objectives
	of this course are to:			
	Introduce the student to the basic principles required to a	nalyse the effects of forces applied to	rigid hadies structur	al elements and simple
	structures in equilibrium;	manyse the checks of forces applied to	rigia boaics, stractai	ar ciemento ana simple
	Demonstrate sound techniques of constructing and solving	dealised mathematical models of real	engineering systems:	
	Promote the analytical and problem-solving skills required to			,
			.g p	
Skills	At the end of this course the student is able to:			
	Apply the properties of two- and three-dimensional force system	stems to the analysis of structural eleme	ents and simple structu	res in equilibrium.
	2. Isolate a body in equilibrium by drawing its free-body diagra	m on which all forces acting on the boo	ly are represented.	
	3. Analyse the external effects of forces acting on a single bod	y or a system of bodies in two- and thre	e-dimensional equilib	rium using the free-body
	diagram of the body or system.			
	4. Analyse the internal forces in trusses and beams.			
	5. Solve problems of equilibrium with account for dry friction.			
	6. Determine mass centres and centroids of lines, areas and v	olumes.		
Personal Competence				
Social Competence	Students can: - work in groups and report on the findings, - devi	elop joint solutions in mixed teams a	nd present them to of	thers, - assess the team
•	collaboration and their own share in it.	• •	•	,
Autonomy	Students are able to: - solve the problems independently with the h	elp of hints assess their own strength	s and weaknesses. e.	a, with the aid of the mid-
,	term test.	,,, <u>3</u> .		,
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	1.5 hours Statics: force systems, equilibrium, mass center, friction, to	russes, beams.		
Assignment for the Following	General Engineering Science (English program): Core qualification	: Compulsory		
Curricula	General Engineering Science (English program, 7 semester): Core	qualification: Compulsory		
	· · · · · · · · · · · · · · · · · · ·			

Course L1373: Mechanics I (GES)			
Тур	ecture		
Hrs/wk			
СР	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Radoslaw Iwankiewicz		
Language	EN		
Cycle	WiSe		
Content	 Two-dimensional (2D) force systems.: moment of a force about a point, reduction of a system of forces, resultant. Three-dimensional (3D) force systems; moment of a force about a point and about an axis, reduction of a system of forces, resultant, wrench. Supports and bearings, constraints, reactive forces, mechanical system isolation, free-body diagram. Systems with complete and incomplete fixity. Equilibrium in two and three dimensions. Equations of equilibrium. Plane trusses: forces in members, the method of joints and the method of sections. Space trusses. Simple structures: frames and machines. Mass centers and centroids of lines, areas and volumes. Friction: dry friction, types of friction problems. Beams: internal effects- internal forces. Internal forces in curved-in-plane members. * Flexible cables. * Virtual work principle. * Denotes an additional topic. 		
Literature	 J.L. Meriam and L.G, Kraige, Engineering Mechanics, Vol. 1, Statics, John Wiley & Sons, SI Version, 4th Edition. R.C. Hibbeler, Engineering Mechanics, Statics, Pearson, Prentice Hall, SI, 3rd Edition. 		



Course L1374: Mechanics I (GES)	
Тур	Recitation Section (large)
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Radoslaw Iwankiewicz
Language	EN
Cycle	WiSe
Content	 Two-dimensional (2D) force systems.: moment of a force about a point, reduction of a system of forces, resultant. Three-dimensional (3D) force systems; moment of a force about a point and about an axis, reduction of a system of forces, resultant, wrench. Supports and bearings, constraints, reactive forces, mechanical system isolation, free-body diagram. Systems with complete and incomplete fixity. Equilibrium in two and three dimensions. Equations of equilibrium. Plane trusses: forces in members, the method of joints and the method of sections. Space trusses. Simple structures: frames and machines. Mass centers and centroids of lines, areas and volumes. Friction: dry friction, types of friction problems. Beams: internal effects- internal forces. Internal forces in curved-in-plane members. * Flexible cables. * Virtual work principle. * Denotes an additional topic.
Literature	 J.L. Meriam and L.G, Kraige, Engineering Mechanics, Vol. 1, Statics, John Wiley & Sons, SI Version, 4th Edition. R.C. Hibbeler, Engineering Mechanics, Statics, Pearson, Prentice Hall, SI, 3rd Edition.



Module Manual B. Sc	. "General Engineering Science (English program, 7 semester)"
Module M0577: Nontechnic	cal Complementary Courses for Bachelors
Module Responsible	Dagmar Richter
Admission Requirements	None
Recommended Previous	None
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The Non-technical Academic Programms (NTA)
	imparts skills that, in view of the TUHH's training profile, professional engineering studies require but are not able to cover fully. Self-reliance, self-management, collaboration and professional and personnel management competences. The department implements these training objectives in its teaching architecture, in its teaching and learning arrangements, in teaching areas and by means of teaching offerings in which students can qualify by opting for specific competences and a competence level at the Bachelor's or Master's level. The teaching offerings are pooled in two different catalogues for nontechnical complementary courses. The Learning Architecture

consists of a cross-disciplinarily study offering. The centrally designed teaching offering ensures that courses in the nontechnical academic programms follow the specific profiling of TUHH degree courses.

The learning architecture demands and trains independent educational planning as regards the individual development of competences. It also provides orientation knowledge in the form of "profiles"

The subjects that can be studied in parallel throughout the student's entire study program - if need be, it can be studied in one to two semesters. In view of the adaptation problems that individuals commonly face in their first semesters after making the transition from school to university and in order to encourage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters during the course of

Teaching and Learning Arrangements

provide for students, separated into B.Sc. and M.Sc., to learn with and from each other across semesters. The challenge of dealing with interdisciplinarity and a variety of stages of learning in courses are part of the learning architecture and are deliberately encouraged in specific courses.

Fields of Teaching

are based on research findings from the academic disciplines cultural studies, social studies, arts, historical studies, migration studies, communication studies and sustainability research, and from engineering didactics. In addition, from the winter semester 2014/15 students on all Bachelor's courses will have the opportunity to learn about business management and start-ups in a goal-oriented way.

The fields of teaching are augmented by soft skills offers and a foreign language offer. Here, the focus is on encouraging goal-oriented communication skills, e.g. the skills required by outgoing engineers in international and intercultural situations.

of the courses offered in this area is different as regards the basic training objective in the Bachelor's and Master's fields. These differences are reflected in the practical examples used, in content topics that refer to different professional application contexts, and in the higher scientific and theoretical level of abstraction in the B.Sc.

This is also reflected in the different quality of soft skills, which relate to the different team positions and different group leadership functions of Bachelor's and Master's graduates in their future working life.

Specialized Competence (Knowledge)

Students can

- locate selected specialized areas with the relevant non-technical mother discipline,
- outline basic theories, categories, terminology, models, concepts or artistic techniques in the disciplines represented in the learning area,
- different specialist disciplines relate to their own discipline and differentiate it as well as make connections,
- sketch the basic outlines of how scientific disciplines, paradigms, models, instruments, methods and forms of representation in the specialized sciences are subject to individual and socio-cultural interpretation and historicity,
- Can communicate in a foreign language in a manner appropriate to the subject.

Skills Professional Competence (Skills)

In selected sub-areas students can

- apply basic methods of the said scientific disciplines,
- auestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specialist discipline,
- · to handle simple questions in aforementioned scientific disciplines in a sucsessful manner,
- justify their decisions on forms of organization and application in practical questions in contexts that go beyond the technical relationship to the subject.

Personal Competence

Social Competence | Personal Competences (Social Skills)

Students will be able

- · to learn to collaborate in different manner,
- to present and analyze problems in the abovementioned fields in a partner or group situation in a manner appropriate to the addressees,
- to express themselves competently, in a culturally appropriate and gender-sensitive manner in the language of the country (as far as this study-
- to explain nontechnical items to auditorium with technical background knowledge.



Autonomy	Personal Competences (Self-reliance)
	Students are able in selected areas
	to reflect on their own profession and professionalism in the context of real-life fields of application
	to organize themselves and their own learning processes
	to reflect and decide questions in front of a broad education background
	to communicate a nontechnical item in a competent way in writen form or verbaly
	to organize themselves as an entrepreneurial subject country (as far as this study-focus would be chosen)
Workload in Hours	Depends on choice of courses
Credit points	6

С				

Information regarding lectures and courses can be found in the corresponding module handbook published separately.



Module M1139: Physics for	Engineers (GES)			
Courses				
Title		Тур	Hrs/wk	CP
Physics for Engineers (GES) (L0557)		Lecture	2	3
Physics for Engineers (GES) (L0560)		Recitation Section (small)	1	1
Module Responsible	Dr. Alexander Petrov			
Admission Requirements	None			
Recommended Previous	Calculus and linear algebra on high school lev	vel		
Knowledge	Physics on high school level			
	Thysica changit concerned.			
Educational Objectives	After taking part successfully, students have reached t	he following learning results		
Professional Competence				
Knowledge	Students can explain fundamental topics and laws of	physics such as in the areas of mechanics, oscill-	ations,	
	waves, and optics.			
	Students can relate physics topics to technical problem	me.		
Skills	Students can relate physics topics to technical problems. Students can describe physical problems mathematically and solve such problems within the framework of			
Skills	their acquired mathematical expertise.			
	their acquired mathematical expense.			
Personal Competence				
Social Competence	Students can jointly solve subject related problems in	groups. They can present their results effectively	,	
	within the framework of the problem solving courses.			
Autonomy	Students are capable to extract relevant information	from the provided references and to relate this	information to the content	of the lecture. They can
Autonomy	reflect their acquired level of expertise with the help	•		•
	connect their knowledge with that acquired from other		xam typical exam questic	ins. Oludents are able to
	connect their knowledge with that acquired from other	location.		
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42			
Credit points	4	·	<u> </u>	<u> </u>
Examination	Written exam			
Examination duration and scale	120 min, 10 problems with two parts a) and b) plus ph	ysics lab attestation		
Assignment for the Following	General Engineering Science (English program): Core	e qualification: Compulsory		
Curricula	General Engineering Science (English program, 7 sei	mester): Core qualification: Compulsory		

Course L0557: Physics for Engineer	s (GES)
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Alexander Petrov
Language	EN
Cycle	WiSe
Content	 Introduction Kinematics and dynamics Work, Energy, momentum Rotatory Motion, moments of inertia Gravitation Special Theory of Relativity Oscillations Waves Geometrical optics Wave optics Matter waves Fundamentals of quantum mechanics
Literature	 D. Halliday, R. Resnick and J. Walker ("HRW-7"), Fundamentals of Physics – Extended Edition, 7th ed., (Wiley 2005); available in the TUHH Library 'Lehrbuchsammlung'. K. Cummings, P. Laws, E. Redish, and P. Cooney ("CLRC"), Understanding Physics, (Wiley 2004); available in the TUHH Library 'Lehrbuchsammlung'. Other books that cover similar topics are, e.g., Physics by Fishbane, Gasiorowicz and Thornton and Physics by Tipler and Mosca.



Course L0560: Physics for Enginee	course L0560: Physics for Engineers (GES)		
Тур	Recitation Section (small)		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Dr. Alexander Petrov		
Language	EN		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		



Module M0671: Technical 1	Thermodynamics I			
Courses				
Title		Тур	Hrs/wk	CP
Technical Thermodynamics I (L0437)		Lecture	2	4
Technical Thermodynamics I (L0439)		Recitation Section (large)	1	1
Technical Thermodynamics I (L0441)		Recitation Section (small)	1	1
Module Responsible	Prof. Gerhard Schmitz			
Admission Requirements	none			
Recommended Previous	Elementary knowledge in Mathematics and Mechanics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence				
Knowledge	Students are familiar with the laws of Thermodynamics. They know	the relation of the kinds of energy a	according to 1st law of 1	Thermodynamics and are
	aware about the limits of energy conversions according to 2 nd law of	•	•	•
	variables and know the meaning of different state variables like ten		-	•
	able to draw the Carnot cycle in a Thermodynamics related diagram		-	
	use the related equations of state. They know the meaning of a funda			-
		·	•	,
Skills	Students are able to calculate the internal energy, the enthalpy, the	kinetic and the potential energy as w	vell as work and heat fo	r simple change of states
	and to use this calculations for the Carnot cycle. They are able to co			
	variables.			
Personal Competence				
Social Competence	The students are able to discuss in small groups and develop an app	proach.		
Autonomy	Students are able to define independently tasks, to get new knowled	ge from existing knowledge as well	as to find ways to use th	ne knowledge in practice.
Washing die Harre	Indicated Old Tax 404 Old Tax in Late 450			
Workload in Hours Credit points	Independent Study Time 124, Study Time in Lecture 56			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following		Compulsory		
Curricula	General Engineering Science (German program): Core qualification: General Engineering Science (German program, 7 semester): Core of			
Curricula	Bioprocess Engineering: Core qualification: Compulsory	qualification. Compulsory		
	Energy and Environmental Engineering: Core qualification: Compuls	con.		
	General Engineering Science (English program): Core qualification:	,		
	General Engineering Science (English program, 7 semester): Core q			
	Computational Science and Engineering: Specialisation Engineering			
	Mechanical Engineering: Core qualification: Compulsory	,		
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Elective	e Compulsory		
	Process Engineering: Core qualification: Compulsory			



T	Lacture
	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Gerhard Schmitz
Language	DE
Cycle	SoSe
Content	1. Introduction
	2. Fundamental terms
	Thermal Equilibrium and temperature
	3.1 Thermal equation of state
	4. First law
	4.1 Heat and work
	4.2 First law for closed systems
	4.3 First law for open systems
	4.4 Examples
	5. Equations of state and changes of state
	5.1 Changes of state
	5.2 Cycle processes
	6. Second law
	6.1 Carnot process
	6.2 Entropy
	6.3 Examples
	6.4 Exergy
	7. Thermodynamic properties of pure fluids
	7.1 Fundamental equations of Thermodynamics
	7.2 Thermodynamic potentials
	7.3 Calorific state variables for arbritary fluids
	7.4 state equations (van der Waals u.a.)
Literature	
Literature	Schmitz, G.: Technische Thermodynamik, TuTech Verlag, Hamburg, 2009
	Baehr, H.D.; Kabelac, S.: Thermodynamik, 15. Auflage, Springer Verlag, Berlin 2012
	Potter, M.; Somerton, C.: Thermodynamics for Engineers, Mc GrawHill, 1993

Course L0439: Technical Thermody	ourse L0439: Technical Thermodynamics I		
Тур	Recitation Section (large)		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Prof. Gerhard Schmitz		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Course L0441: Technical Thermody	Course L0441: Technical Thermodynamics I		
Тур	Recitation Section (small)		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Prof. Gerhard Schmitz		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		



Module M0772: Electrical E	ngineering II				
Courses					
Title		Тур	Hrs/wk	СР	
Electrical Engineering II (L0747)		Lecture	3	5	
Electrical Engineering II (L0748)		Recitation Section (small)	2	1	
Module Responsible	Dr. Helge Fielitz				
Admission Requirements	None				
Recommended Previous	Content of the Lecture "Electrical Engineering I (Elektrotechnik I)	п			
Knowledge					
Educational Objectives	After taking part successfully, students have reached the following	ng learning results			
Professional Competence					
Knowledge	The students know the basic theory, relations and methods of	time dependent network theory and basic	nonlinear circuit ele	ments. This includes, in	
	particular:				
	• transients,				
	the use of complex numbers and phasors,				
	the concept of impedance, the concept of impedance,				
	steady state sinusoidal circuit analysis, acompley power and 2 phase systems.				
	 complex power and 3-phase systems, transformers. 				
	transfer function and filters,				
	the concept of resonance,				
	diodes and rectifiers,				
	diodes and rectiners, bipolar transistors and operational amplifiers				
	- Sipolar transitions and operational amplinors				
Skills	The students are able to establish relations between time dependent currents and voltages in linear networks. The students know how to apply network				
	theory to analyze 3-phase systems, transformers, filter-like structures, and resonating networks. The students know to include basic nonlinear circuit				
	elements, such as diodes, bipolar transistors, and operational amplifiers, into the network analysis.				
Personal Competence					
Social Competence	Students are able to solve specific problems, alone or in a group	and to present the results accordingly. St.	idente can evoluin co	ncents and on the basis	
Social Competence	of examples and exercises, verify and deepen their understanding		лавнів сан ехріаій СС	moopis and, on the basis	
	or examples and exercises, verily and deepen their understanding	ng.			
Autonomy	Students are able to acquire particular knowledge using textbo	Students are able to acquire particular knowledge using textbooks in a self-learning process, to integrate, present, and associate this knowledge with			
	other fields. The students develop persistency to also solve more	e complicated problems.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70				
Credit points	6				
Examination	Written exam				
Examination duration and scale	120 minutes				
	General Engineering Science (English program): Core qualification	tion: Compulsory			
Assignment for the Following Curricula	General Engineering Science (English program): Core qualifications of the General Engineering Science (English program, 7 semester): Co				
Curricula	deneral Engineering Science (English program, 7 semester): Co	ore qualification. Compulsory			

Course L0747: Electrical Engineerin	ıg II
Тур	Lecture
Hrs/wk	3
СР	5
Workload in Hours	Independent Study Time 108, Study Time in Lecture 42
Lecturer	Dr. Helge Fielitz
Language	EN
Cycle	SoSe
Content	 Transients Periodic and sinusoidal signals Power in AC circuits Three-phase systems Transformers Harmonic analysis, transfer functions, filters, locus curve, and Bode plot Resonant circuits Diodes and nonlinear circuits Bipolar transistor and operational amplifier
Literature	A.R. Hambley: "Electrical Engineering", 5th ed., (Pearson, 2011) M. Albach: "Elektrotechnik", (Pearson, 2011).



Course L0748: Electrical Engineering	Course L0748: Electrical Engineering II		
Тур	Recitation Section (small)		
Hrs/wk	2		
CP	1		
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28		
Lecturer	Dr. Helge Fielitz		
Language	EN		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		



Madula MOZOZ, Madaanada	al Ameliais			
Module M0737: Mathematic	cal Analysis			
Courses				
Title		Тур	Hrs/wk	СР
Mathematical Analysis (L0647)		Lecture	4	4
Mathematical Analysis (L0648)		Recitation Section (large)	2	2
Mathematical Analysis (L0649)		Recitation Section (small)	2	2
Module Responsible	Prof. Marko Lindner			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the followin	g learning results		
Professional Competence				
Knowledge	Students can name the basic concepts in analysis. They a	are able to explain them using appropriate	examples	
	Students can harne the basic concepts in analysis. They a Students can discuss logical connections between these			th the help of examples
	They know proof strategies and can reproduce them.	concepts. They are expanse or musicating	areae connections wi	artific field of examples.
	They will be proof strategies and sair reproduce them.			
Skills				
Skills	Students can model problems in analysis with the help	of the concepts studied in this course. M	oreover, they are cap	able of solving them by
	applying established methods.			
	Students are able to discover and verify further logical connections between the concepts studied in the course.			
	For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results.			
Personal Competence				
Social Competence	- Students are able to work together (e.g. on their regular home work) in heterogeneously composed teams (i.e., teams from different study programs and			
	background knowledge) and to present their results appropriately (e.g. during exercise class).			
A	Charleste are complete of the plane their and even all the formal			Saalis and Industrial Co. A.
Autonomy	- Students are capable of checking their understanding of comple	ex concepts on their own. They can specify	y open questions prec	isely and know where to
	get help in solving them.			
	- Students can put their knowledge in relation to the contents of o	ther lectures		
	- Otogenia can put trieli knowledge in relation to trie contents of o	uioi iociuios.		
	- Students have developed sufficient persistence to be able to wo	irk for longer periods in a goal-criented m	anner on hard probler	ne
	- Cludents have developed suincient persistence to be able to we	ink for longer periods in a goar-onemed ma	anner on nara probler	110.
Workload in Hours	Independent Study Time 128, Study Time in Lecture 112			
Credit points	8			
Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following	Computer Science: Core qualification: Compulsory			
Curricula	General Engineering Science (English program): Core qualificati	on: Compulsory		
	General Engineering Science (English program, 7 semester): Co	re qualification: Compulsory		

Course L0647: Mathematical Analys	Course L0647: Mathematical Analysis	
Тур	Lecture	
Hrs/wk	4	
СР	4	
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56	
Lecturer	Dr. Francisco Javier Hoecker-Escuti	
Language	EN	
Cycle	SoSe	
Content	Convergence, sequences, and series	
	Continuity	
	Elementary functions	
	Differential calculus	
	Integral calculus	
	Sequences of functions	
Literature	Kőnigsberger: Analysis	
	Forster: Analysis	



Course L0648: Mathematical Analys	Course L0648: Mathematical Analysis	
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Francisco Javier Hoecker-Escuti	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0649: Mathematical Analys	Course L0649: Mathematical Analysis	
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Francisco Javier Hoecker-Escuti	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1103: Mechanics	II (GES)			
Courses				
litle		Тур	Hrs/wk	СР
Mechanics II (GES) (L1417)		Lecture	2	3
Mechanics II (GES) (L1418)		Recitation Section (large)	2	3
Module Responsible	Prof. Radoslaw Iwankiewicz			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	The primary purpose of the study of Mechanics of Materials/S	olids is to develop the capacity to predict	the effects of forces or	n elastic bodies, structur
	elements and simple structures, which are at rest (in equilibrium	n). Such a capacity is critical to the design	of many structural or	engineering systems. Th
	particular objectives of this course are to:			
	Introduce the student to the basic principles required to	analyse the effects of forces applied to	elastic hodies structi	ıral elements and simpl
	structures in equilibrium;	s analyses are should be locate applied to	oladio boaloo, diradi	arar oromonio ana omp
	Demonstrate sound techniques of constructing and solvi	ng idealised mathematical models of real	engineering systems:	
	Promote the analytical and problem-solving skills require			
Skills	At the end of this course the student should be able to:			
	Determine average normal and shear stresses.			
	Determine shear stresses and the angle of twist due to to	orsion of a circular shaft.		
	Determine thermal stresses in rods.			
	Analyse statically indeterminate rods and shafts			
	Determine area moments of inertia as well as principal a Determine normal and shear stresses as well as deflections.			
	Analyse plane state of stress (stress transformation).	ons due to bending.		
	Analyse stability of equilibrium of simple systems and but the stability of equilibrium of simple systems and but the systems and but the systems are stability of equilibrium of simple systems and but the systems are systems.	ckling of elastic columns		
	Determine displacements and solve statically indetermin	•	tialiano's) method.	
		and processes may are and or one gy (can		
Personal Competence				
Social Competence	Students can: -work in groups and report on the findings, - of	levelop joint solutions in mixed teams a	and present them to o	thers, - assess the tea
	collaboration and their own share in it.			
Autonomy	Students are able to; - solve the problems independently with	the help of hints, - assess their own stren	ngths and weaknesses	s, e.g. with the help of th
	mid-term test.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	1.5 hours Mechanics of Solids: stress and strain due to axial	loading, torsion, bending, stress transfe	ormation, moments of	inertia, buckling, energ
	methods.			
Assignment for the Following	General Engineering Science (English program): Core qualifica			
Curricula	General Engineering Science (English program, 7 semester): C	ore qualification: Compulsory		



Course L1417: Mechanics II (GES)	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Radoslaw Iwankiewicz
Language	EN
Cycle	SoSe
Content	COURSE CONTENTS:
	 Normal and shear stress, average normal and shear stress. Normal and shear strain. Axial loading: elastic deformation and statically indeterminate problems. Thermal stresses. Statically indeterminate axially loaded rods. Area moments of inertia. Torsion of a circular shaft: shear strain and stress, the angle of twist. Bending. Pure and symmetric bending: normal strain and stress. Deflection of beams: elastic curve. Statically indeterminate beams. Un-symmetric bending. Bending with a transverse shear: shear stresses in beams. Shear flow in thin-walled members, shear center. Plane-stress transformation. Stability of equilibrium and buckling of elastic columns. Elastic strain energy and energy methods: Castigliano's theorem - determination of displacements and statically indeterminate problems. *Membrane theory of rotational shells: thin-walled pressure vessels.* (*) denotes an additional topic.
Literature	 R.C. Hibbeler, Mechanics of Materials, Pearson, Prentice Hall, SI 2nd Edition R.C. Hibbeler, Engineering Mechanics, Statics, Pearson, Prentice Hall, SI 3rd Edition J.L. Meriam and L.G, Kraige, Engineering Mechanics, Vol. 1, Statics, John Wiley & Sons, SI Version, 4th Edition

Course L1418: Mechanics II (GES)	Course L1418: Mechanics II (GES)	
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Radoslaw Iwankiewicz	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1348: Fundament	tals of Mechanical Engineering (GES)			
wodule ivi 1340. i dildameni	ials of Mechanical Engineering (GES)			
Courses				
ïtle		Тур	Hrs/wk	СР
undamentals of Mechanical Engineering	(GES) (L1898)	Lecture	2	3
undamentals of Mechanical Engineering	(GES) (L1899)	Recitation Section (small)	2	3
Module Responsible	Dr. Arthur Seibel			
Admission Requirements	None			
Recommended Previous Knowledge	Basic knowledge about mechanics and production eng Internship (Stage I Practical)	ineering		
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results		
Professional Competence		g		
Knowledge	After passing the module, students are able to:			
	 explain basic working principles and functions of machine elements, explain requirements, selection criteria, application scenarios and practical examples of basic machine elements, indicate the background of dimensioning calculations. 			
SAIII S	After passing the module, students are able to: accomplish dimensioning calculations of covered mach transfer knowledge learned in the module to new requii recognize the content of technical drawings and schem technically evaluate basic designs.	rements and tasks (problem solving skills),		
Personal Competence Social Competence Autonomy	Students are able to discuss technical information in the lecture Students are able to independently deepen their acquire Students are able to acquire additional knowledge a lectures.	red knowledge in exercises.	tent e.g. by using the	video recordings of
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following Curricula	General Engineering Science (English program, 7 semester): 0	Core qualification: Compulsory		

Course L1898: Fundamentals of Mechanical Engineering (GES)		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Arthur Seibel	
Language	EN	
Cycle	SoSe	
Content	Lecture	
	 Introduction to design Introduction to the following machine elements Screws Shaft-hub joints Rolling contact bearings Welding / adhesive / solder joints Springs Axes & shafts Presentation of technical objects (technical drawing) Exercise Calculation methods for dimensioning the following machine elements: Screws Shaft-hub joints Rolling contact bearings Welding / adhesive / solder joints Springs Axis & shafts 	
Literature		



Course L1899: Fundamentals of Me	Course L1899: Fundamentals of Mechanical Engineering (GES)	
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Arthur Seibel	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0688: Technical 1	Thermodynamics II			
Courses				
Title		Тур	Hrs/wk	CP
Technical Thermodynamics II (L0449)		Lecture	2	4
Technical Thermodynamics II (L0450)		Recitation Section (large)	1	1
Technical Thermodynamics II (L0451)		Recitation Section (small)	1	1
Module Responsible	Prof. Gerhard Schmitz			
Admission Requirements	none			
Recommended Previous	Elementary knowledge in Mathematics, Mechanics and Technical	Thermodynamics I		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	earning results		
Professional Competence				
Knowledge	Students are familiar with different cycle processes like Joule, Otto, exergetic efficiencies and know the influence different factors. They cooling cycle). They have increased knowledge of steam cycles a know the laws of gas mixtures, especially of humid air processes a knowledge in gas dynamics and know the definition of the speed of the s	whow the difference between anti clo and are able to draw the different cycl and are able to perform simple combus	ckwise and clockwise es in Thermodynamic stion calculations. The	cycles (heat-power cycles related diagrams. The
Skills	Students are able to use thermodynamic laws for the design of te balances and by this to optimise technical processes. They are a They are able to transform a verbal formulated message into an ab	ble to perform simple safety calculation		
Personal Competence Social Competence Autonomy	The students are able to discuss in small groups and develop an a Students are able to define independently tasks, to get new knowle		is to find ways to use th	ne knowledge in practice
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Core qualificatio	n: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Core	qualification: Compulsory		
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compu	llsory		
	General Engineering Science (English program): Core qualification	n: Compulsory		
	General Engineering Science (English program, 7 semester): Core	qualification: Compulsory		
	Computational Science and Engineering: Specialisation Engineeri	ng Sciences: Elective Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Election	ve Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			
	Technomathematics: Core qualification: Elective Compulsory			
	Process Engineering: Core qualification: Compulsory			
	1 100000 Engineering. Oute quantication. Compulsory			



Course L0449: Technical Thermody	Course L0449: Technical Thermodynamics II	
Тур	Lecture	
Hrs/wk	2	
CP	4	
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28	
Lecturer	Prof. Gerhard Schmitz	
Language	DE	
Cycle	WiSe	
Content	8. Cycle processes	
	7. Gas - vapor - mixtures 10. Open sytems with constant flow rates 11. Combustion processes 12. Special fields of Thermodynamics	
Literature	 Schmitz, G.: Technische Thermodynamik, TuTech Verlag, Hamburg, 2009 Baehr, H.D.; Kabelac, S.: Thermodynamik, 15. Auflage, Springer Verlag, Berlin 2012 Potter, M.; Somerton, C.: Thermodynamics for Engineers, Mc GrawHill, 1993 	

Course L0450: Technical Thermodynamics II	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Gerhard Schmitz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0451: Technical Thermodynamics II	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Gerhard Schmitz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0853: Mathematic	es III			
Courses				
Title		Тур	Hrs/wk	СР
Analysis III (L1028)		Lecture	2	2
Analysis III (L1029)		Recitation Section (small)	1	1
Analysis III (L1030)		Recitation Section (large)	1	1
Differential Equations 1 (Ordinary Differen	tial Equations) (L1031)	Lecture	2	2
Differential Equations 1 (Ordinary Differen		Recitation Section (small)	1	1
Differential Equations 1 (Ordinary Differen	tial Equations) (L1033)	Recitation Section (large)	1	1
Module Responsible	Prof. Anusch Taraz			
Admission Requirements	none			
Recommended Previous	Mathematics I + II			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge	Students can name the basic concents in the	area of analysis and differential equations. They	, are able to explain	them using appropriate
	· ·	area of analysis and differential equations. They	are able to explain	i tiletti usitig appropriate
	examples.	oon those concents. They are conclude of illustrating	those connections w	ith the help of everyles
		een these concepts. They are capable of illustrating	these connections w	itii tile lielp of examples.
	They know proof strategies and can reproduce	tnem.		
Skills	Students can model problems in the area of a	nalysis and differential equations with the help of t	he concents studied	in this course Mareover
	·		ne concepts studied	III tills course. Moreover
	they are capable of solving them by applying es		H	
	· ·	logical connections between the concepts studied in		
	For a given problem, the students can develop	and execute a suitable approach, and are able to cri	tically evaluate the re	esults.
Personal Competence				
Social Competence				
,	 Students are able to work together in teams. Th 	ey are capable to use mathematics as a common la	nguage.	
	 In doing so, they can communicate new conce 	pts according to the needs of their cooperating par	tners. Moreover, they	can design examples to
	check and deepen the understanding of their pe	eers.		
Autonomy				
,	 Students are capable of checking their unders 	tanding of complex concepts on their own. They ca	in specify open ques	tions precisely and know
	where to get help in solving them.			
	 Students have developed sufficient persistence 	to be able to work for longer periods in a goal-orien	ted manner on hard	problems.
Workload in Hours	Independent Study Time 128, Study Time in Lecture 11	2		
Credit points	8			
Examination	Written exam			
Examination duration and scale	60 min (Analysis III) + 60 min (Differential Equations 1)			
Assignment for the Following	General Engineering Science (German program): Core	·		
Curricula	General Engineering Science (German program, 7 sen			
	Civil- and Environmental Engineering: Core qualification	• •		
	Bioprocess Engineering: Core qualification: Compulso	ry		
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification	tion: Compulsory		
	General Engineering Science (English program): Core	qualification: Compulsory		
	General Engineering Science (English program, 7 sem			
	Computational Science and Engineering: Core qualific	ation: Compulsory		
	Mechanical Engineering: Core qualification: Compulso			
	Mechatronics: Core qualification: Compulsory	,		
	Naval Architecture: Core qualification: Compulsory			
	, , , ,			
	Process Engineering: Core qualification: Compulsory			



Course L1028: Analysis III	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	Main features of differential and integrational calculus of several variables
	Differential calculus for several variables Mean value theorems and Taylor's theorem Maximum and minimum values Implicit functions Minimization under equality constraints Newton's method for multiple variables Double integrals over general regions Line and surface integrals Theorems of Gauß and Stokes
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html

Course L1029: Analysis III	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L1030: Analysis III	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L1031: Differential Equation	s 1 (Ordinary Differential Equations)	
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	WiSe	
Content	Main features of the theory and numerical treatment of ordinary differential equations Introduction and elementary methods Exsitence and uniqueness of initial value problems Linear differential equations Stability and qualitative behaviour of the solution Boundary value problems and basic concepts of calculus of variations Eigenvalue problems Numerical methods for the integration of initial and boundary value problems Classification of partial differential equations	
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html	



Course L1032: Differential Equations 1 (Ordinary Differential Equations)	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L1033: Differential Equations 1 (Ordinary Differential Equations)	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M1105: Mechanics	III (GES)			
Courses				
Courses		T	Unabula	O.D.
Title		Typ	Hrs/wk 3	CP 3
Mechanics III (GES) (L1421) Mechanics III (GES) (L1420)		Lecture Recitation Section (small)	2	2
Mechanics III (GES) (L1419)		Recitation Section (large)	1	1
Module Responsible	Prof. Radoslaw Iwankiewicz			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	The primary purpose of the study of Mechanics III (Fluid Statics	, Kinematics and Kinetics) is to develop	the capacity to predict	the effects of forces and
	motions, necessary for the analysis and design of moving mach	nine parts, different machinery, vehicles,	aircraft, spacecraft, au	tomatic control systems
	etc.The particular objectives of this course are to:			
	Determine the hydrostatic forces acting on different object	ts.		
	Analyse stability of floating bodies.			
	Analyse the kinematics and kinetics of a particle in difference of the control of the contr	rent reference systems,		
	Analyse the motion of the system of particles and forces a			
	5. Analyse the plane motion of a rigid body (simple mechan	ism) and forces acting on it.		
	6. Analyse the three-dimensional motion of a rigid body and	forces acting on it.		
Skills				
	Solve the equilibrium problems with account for hydrosta	ic pressure forces.		
	Analyse stability of simple floating bodies.	•		
	3. Calculate the velocity and acceleration of a particle in different	reference systems.		
	4. Derive and solve the equation of motion of a particle in	different reference systems.		
	5. Analyse the motion of the system of particles and forces acting on it with the aid of work-energy and impulse-momentum relationships,			
	6. Calculate the instantaneous linear and angular velocities and accelerations of the planar mechanisms.			
	7. Derive and solve the equations of a plane motion of a rigid body and find forces acting on it,			
	8. Apply work-energy and impulse-momentum relationships to a	8. Apply work-energy and impulse-momentum relationships to analyse plane kinetics of a rigid body.		
	9. Calculate the instantaneous linear and angular velocities and	accelerations of the three-dimensional r	motion of a rigid body.	
	10. Derive the equations of a motion of a three-dimensional mot	on of a rigid body.		
	11. Apply in three-dimensional kinematics and kinetics of rigid b	ody both methods of vector algebra and	matrix methods.	
Personal Competence				
Social Competence	Students can: - work in groups and report on the findings, - d collaboration and their share in it.	evelop joint solutions in mixed teams a	nd present them to ot	hers, - assess the team
Autonomy	Students are able to: -solve the problems independently with the	help of hints, - assess their own strength	s and weaknesses, e.g	. with the aid of the mid
,	term test.	· ·		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	2 hours Fluid Statics: hydrostatic pressure, buoyancy, stability of	floating vessels. Kinematics of particle, of	of plane and 3D rigid b	od,y. Kinetics of particle
	system of particles, of plane and 3D rigid body. Vector and matrix	algebra formulation.		
Assignment for the Following	General Engineering Science (English program): Core qualificat	on: Compulsory		
Curricula	General Engineering Science (English program, 7 semester): Co	re qualification: Compulsory		
	Computational Science and Engineering: Specialisation Engineer	ering Sciences: Elective Compulsory		

Course L1421: Mechanics III (GES)	
Тур	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Radoslaw Iwankiewicz
Language	EN
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L1420: Mechanics III (GES)		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Radoslaw Iwankiewicz	
Language	EN	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1419: Mechanics III (GES)		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Radoslaw Iwankiewicz	
Language	EN	
Cycle	WiSe	
Content	FLUID STATICS	
	Fluid pressure, hydrostatic pressure on flat and cylindrical surfaces.	
	Buoyancy force, buoyancy center, metacenter, stability of floating objects.	
	KINEMATICS	
	Kinematics of a particle. Plane curvilinear motion: rectangular coordinates, normal and tangential coordinates, polar coordinates. Space curvilinear motion.	
	2. Constrained motion of connected particles.	
	3. Plane kinematics of a rigid body.	
	4. Relative (compound) motion.	
	5. Three-dimensional kinematics of a rigid body.	
	KINETICS	
	Kinetics of a particle and of a system of particles.	
	2. Plane kinetics of a rigid body.	
	3. Three-dimensional kinetics of a rigid body.	
Literature	1. J.L. Meriam and L.G, Kraige, Engineering Mechanics, Vol. 2, Dynamics, John Wiley & Sons, SI Version, 4 th Edition	
	2 . R.C. Hibbeler, Engineering Mechanics, Dynamics, Pearson, Prentice Hall, SI 3 rd Edition	



Module M1273: Advanced Internship GES			
Courses			
Title	Typ Hrs/wk CP		
Module Responsible	Prof. Gerhard Schmitz		
Admission Requirements	None		
Recommended Previous	150 ECTS Credits in General Engineering Science		
Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	Students of the different specialisations get experiences in typical scope of duties of engineers, who are working in a development division, planning		
	division or in the management of a company. In the framework of this environment the knowledge from university can used a first time for real		
	engineering tasks.		
Skills	Students of the different specialisations should be integrated in typical day's work. By this they are learning typical tasks and functions of engineers. They		
	are able to structure and organize their working day and to finish tasks in a certain time.		
Personal Competence			
Social Competence	Students are able to cooperate with co-workers in a company and to understand the language of engineers.		
,			
Autonomy	Students can finish own tasks.		
Workload in Hours	Independent Study Time 540, Study Time in Lecture 0		
Credit points	18		
Examination	Written elaboration (accord. to Internship Regulations)		
Examination duration and scale	see Internship Regulations		
Assignment for the Following	General Engineering Science (German program, 7 semester): Core qualification: Compulsory		
Curricula	General Engineering Science (English program, 7 semester): Core qualification: Compulsory		



Specialization Civil Engineering

In the specialization "civil engineering" the graduates attain the basic competences to plan, build and repair structures like bridges and tunnels, structures in hydraulic engineering, as well as industrial and housing construction. The specialization allows the transition to the master program civil engineering.

es				
		Тур	Hrs/wk	СР
Physics (L0217)	Lecture 2 2			
Physics (L0219)		Recitation Section (large)	1	1
Physics (L0247)		Recitation Section (small)	1	1
s of Building Materials (L0215)		Lecture	2	2
Module Responsible P	Prof. Frank Schmidt-Döhl			
Admission Requirements N	None			
Recommended Previous K	Knowledge of physics, chemistry and mathematics from scho	lo		
Knowledge				
Educational Objectives A	After taking part successfully, students have reached the follo	wing learning results		
Professional Competence				
th a a second Skills To e	The students are able to identify fundamental effects of action to materials and structures, to explain different types of mechanical behaviour, to describe the structure of building materials and the correlations between structure and other properties, to show methods of joining and of corrosion processes and to describe the most important regularities and properties of building materials and structures and their measurement in the field of protection against moisture, coldness, fire and noise. The students are able to work with the most important standardized methods and regularities in the field of moisture protection, the German regulation for energy saving, fire protection and noise protection in the case of a small building.			
·				
Autonomy II	The students are able to make the timing and the operation steps to learn the specialist knowledge of a very extensive field.			
Workload in Hours In	ndependent Study Time 96, Study Time in Lecture 84			
Credit points 6	3			
Examination W	Written exam			
mination duration and scale 2	2 stündige Klausur			
ssignment for the Following G	General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory			
Curricula G	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory			
C	Divil- and Environmental Engineering: Core qualification: Cor	mpulsory		
G	General Engineering Science (English program): Specialisati	on Civil- and Enviromental Engeneering: Com	pulsory	
G	General Engineering Science (English program, 7 semester):	Specialisation Civil Engineering: Compulsory		
Т	Fechnomathematics: Specialisation III. Engineering Science:	Elective Compulsory		

Course L0217: Building Physics	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	Heat transport, thermal bridges, balances of energy consumption, German regulation for energy saving, heat protection in summer, moisture transport,
	condensation moisture, protection against mold, fire protection,
	noise protection
Literature	Fischer, HM.; Freymuth, H.; Häupl, P.; Homann, M.; Jenisch, R.; Richter, E.; Stohrer, M.: Lehrbuch der Bauphysik. Vieweg und Teubner Verlag,
	Wiesbaden, ISBN 978-3-519-55014-3

Course L0219: Building Physics	Course L0219: Building Physics	
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Frank Schmidt-Döhl	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0247: Building Physics		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Frank Schmidt-Döhl	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0215: Principles of Building Materials		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Frank Schmidt-Döhl	
Language	DE	
Cycle	WiSe	
Content	Structure of building materials	
	Effects of action	
	Fundamentals of mechanical behaviour	
	Principles of metals	
	Joining methods	
	Corrosion	
Literature	Wendehorst, R.: Baustoffkunde. ISBN 3-8351-0132-3	
	Scholz, W.:Baustoffkenntnis. ISBN 3-8041-4197-8	



Module M0740: Structural A	Analysis I			
Courses				
Title		Тур	Hrs/wk	СР
Structural Analysis I (L0666)		Lecture	2	3
Structural Analysis I (L0667)		Recitation Section (large)	2	3
Module Responsible	Prof. Uwe Starossek			
Admission Requirements				
·				
	none			
Recommended Previous	Mechanics I, Mathematics I			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following lea	rning results		
Professional Competence				
Knowledge	After successfully completing this module, students can express the ba	asic aspects of linear frame analysis	of statically determina	ite systems.
Skills	After successful completion of this module, the students are able to	distinguish between statically detern	ninate and indetermin	nate structures. They are
	able to analyze state variables and to construct influence lines of station			•
Personal Competence				
Social Competence	Students can			
	 participate in subject-specific and interdisciplinary discussions 			
	defend their own work results in front of others			
	promote the scientific development of colleagues			
	Furthermore, they can give and accept professional constructive	ve criticism		
Autonomy	The students are able work in-term homework assignments. Due to the	ne in-term feedback they are enable	d to self-assess their	learning progress during
. atonomy	the lecture period, already.		2 12 2011 400000 111011	g progress during
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 Minuten	and Endows to 1 - 2		
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation Civil			
Curricula	General Engineering Science (German program, 7 semester): Special Civil- and Environmental Engineering: Core qualification: Compulsory		У	
	General Engineering Science (English program): Specialisation Civil-		npulsorv	
	General Engineering Science (English program, 7 semester): Special			
	Technomathematics: Specialisation III. Engineering Science: Elective		•	

Course I OCCC - Church and Amelysis I		
Course L0666: Structural Analysis I		
Тур	ecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Uwe Starossek	
Language	DE	
Cycle	WiSe	
	Statically determinate structural systems • basics: statically determinacy, equilibrium, method of sections • forces: determination of support reactions and internal forces • influence lines of forces • displacements: calculation of discrete displacements and rotations, calculation of deflection curves • principle of virtual displacements and virtual forces • work-engergy theorem • differential equation of beam	
Literature	Krätzig, W.B., Harte, R., Meskouris, K., Wittek, U.: Tragwerke 1 - Theorie und Berechnungsmethoden statisch bestimmter Stabtragwerke. 4. Aufl. Springer, Berlin, 1999.	



Course L0667: Structural Analysis I	
Тур	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Uwe Starossek
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0590: Building Ma	aterials and Building Chemistry			
Courses				
Title		Тур	Hrs/wk	CP
Building Materials and Building Chemistry		Lecture	4	4
Building Materials and Building Chemistry		Recitation Section (small)	1	2
Module Responsible	Prof. Frank Schmidt-Döhl			
Admission Requirements	None			
Recommended Previous	Module Principles of Building Materials and Buildin	ng Physics		
Knowledge				
Educational Objectives	After taking part successfully, students have reached	ed the following learning results		
Professional Competence				
Knowledge	The students are able to explain the most importa	ant components, the manufacture, the structure, the	most important characte	eristics of the mechanic
	behaviour and the corrosion behaviour, the materia	al testing and the fields of utilization of all relevant bui	lding materials.	
Skills	The students are able to assess the usability of b	uilding materials for different applications and to sel	ect building materials a	ccording to their speci-
	advantages and disadvantages. The students are able to prepare the mixture of a normal type concrete and to consider the mixture in respect			mixture in respect to the
	actual rules and the connections between the	characteristic concrete parameters. They are able	e to select suitable m	aterials and mixtures
	avoid damage processes.			
Paragnal Compatance				
Personal Competence	The attidents are able to assess to all attended to	Abo sukonoii o nonoialiak kansuladan in lasa		
Social Competence	groups in the lab.	earn the very extensive specialist knowledge in lear	ning groups and to car	ry out exercises in sma
	groups in the lab.			
Autonomy				
Workload in Hours	Independent Study Time 110, Study Time in Lectur	re 70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	2 stündige Klausur			
Assignment for the Following	General Engineering Science (German program, 7	semester): Specialisation Civil Engineering: Comput	sory	
Curricula	Civil- and Environmental Engineering: Core qualifi	cation: Compulsory		
	General Engineering Science (English program, 7	semester): Specialisation Civil Engineering: Compuls	sory	

Course L0248: Building Materials and Building Chemistry		
Тур	ecture	
Hrs/wk	4	
СР	4	
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56	
Lecturer	Prof. Frank Schmidt-Döhl	
Language	DE	
Cycle	SoSe	
Content	Cementing materials, aggregates, admixtures and other components in mortar and concrete, concrete, durability of cement bonded materials, repair of	
	concrete structures, steel, cast iron, non-ferrous metals,	
	metal corrosion, timber, plastics, natural stone, synthetic stones, mortar, masonry, glass, bitumen	
Literature	Wendehorst, R.: Baustoffkunde. ISBN 3-8351-0132-3	
	Scholz, W.:Baustoffkenntnis. ISBN 3-8041-4197-8	
	Henning, O.; Knöfel, D.: Baustoffchemie. ISBN 3-345-00799-1	
	Knoblauch, H.; Schneider, U.: Bauchemie. ISBN 3-8041-5174-4	

Course L0249: Building Materials and Building Chemistry	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl, Klaus-Dieter Henk
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0706: Geotechnic	s I			
modalo morcor doctornino				
Courses				
Title		Тур	Hrs/wk	СР
Soil Mechanics (L0550)		Lecture	2	2
Soil Mechanics (L0551)		Recitation Section (large)	2	2
Soil Mechanics (L1493)		Recitation Section (small)	2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	none			
Recommended Previous	Modules:			
Knowledge				
	Mechanics I-II			
Educational Objectives	After taking part successfully, students have reached the follow	owing learning results		
Professional Competence				
Knowledge	The students know the basics of soil mechanics as the s	tructure and characteristics of soil, stress d	istribution due to we	ight, water or structures,
	consolidation and settlement calculations, as well as failure of	of the soil due to ground- or slope failure.		
Skills	After the successful completion of the module the students should be able to describe the mechanical properties and to evaluate them with the help of			
	geotechnical standard tests. They can calculate stresses and deformation in the soils due to weight or influence of structures. They are are able to prove			
	the usability (settlements) for shallow foundations.			
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulso	ry	
	Civil- and Environmental Engineering: Core qualification: Co	mpulsory		
	General Engineering Science (English program): Specialisat	tion Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (English program, 7 semester)	: Specialisation Civil Engineering: Compulso	ry	

Course L0550: Soil Mechanics		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	SoSe	
Content	 Structure of the soil Ground surveying Compstition and properties of the soil Groundwater One-dimensional compression Spreading of stresses Settlement calculation Consolidation Shear strength Earth pressure Slope failure Ground failure Suspension based earth tenches 	
Literature	 Vorlesungsumdruck, s. ww.tu-harburg.de/gbt Grabe, J. (2004): Bodenmechanik und Grundbau Gudehus, G. (1981): Bodenmechanik Kolymbas, D. (1998): Geotechnik - Bodenmechanik und Grundbau Grundbau-Taschenbuch, Teil 1, aktuelle Auflage 	



Course L0551: Soil Mechanics	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1493: Soil Mechanics	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0613: Reinforced	Concrete I			
Courses				
Title		Тур	Hrs/wk	CP
Project Seminar Concrete I (L0896)		Seminar	1	2
Reinforced Concrete Design I (L0303)		Lecture	2	2
Reinforced Concrete Design I (L0305)		Recitation Section (large)	2	2
Module Responsible	Prof. Günter Rombach			
Admission Requirements	none			
Recommended Previous	Basic knowledge in structural analysis and building materia	als.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fo	llowing learning results		
Professional Competence				
Knowledge	The students can outline the history of concrete construct	ion and explain the basics of structural engin	eering, including usua	al load combinations and
	safety concepts. They are able to draft and dimension s	imple structures, as well as to evaluate and	discuss the behaviour	r of the materials and of
	structural members.			
Skills	The students are able to apply basic procedures of the	conception and dimensioning to practical cas	ses. They are capable	to draft simple concrete
	structures and to design them for bending and bending wi			
	construction sketches and draw up technical descriptions.			
Personal Competence				
Social Competence				
Autonomy	The students are able to carry out simple tasks in the conce	eption and dimensioning of structures and to cr	itically reflect the result	ts.
	,	, , , , , , , , , , , , , , , , , , ,		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following	General Engineering Science (German program): Specialis	sation Civil- and Enviromental Engeneering: C	ompulsory	
Curricula	General Engineering Science (German program, 7 semest	er): Specialisation Civil Engineering: Compuls	ory	
	Civil- and Environmental Engineering: Core qualification: 0	Compulsory		
	General Engineering Science (English program): Specialis	ation Civil- and Enviromental Engeneering: Co	ompulsory	
	General Engineering Science (English program, 7 semeste	er): Specialisation Civil Engineering: Compulso	ory	

Course L0896: Project Seminar Concrete I	
Тур	Seminar
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
Content	In the course of the project seminar, a simple structure is drafted and dimensioned.
Literature	

Course L0303: Reinforced Concrete	Course L0303: Reinforced Concrete Design I	
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	SoSe	
Content	The following subjects/contents are treated: • history of concrete construction • mechanical and physical-chemical properties od concrete and steel • bond between concrete and reinforcement • concepts for dimensioning, limit state models, structural safety • design of linear members for tension and bending with and without axial force	
Literature	Download der Unterlagen zur Vorlesung über Stud.IP!	



Course L0305: Reinforced Concrete Design I	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0744: Structural A	Analysis II			
Courses				
Title		Тур	Hrs/wk	СР
Structural Analysis II (L0673)		Lecture	2	3
Structural Analysis II (L0674)		Recitation Section (large)	2	3
Module Responsible	Prof. Uwe Starossek			
Admission Requirements	None			
Recommended Previous	Mechanics I/II			
Knowledge	Mathematics I/II			
	Differential Equations I			
	Structural Analysis I			
Educational Objectives	After taking part successfully, students have reached the followin	learning results		
Professional Competence				
Knowledge	After successful completion of this module, students can express	he basic aspects of linear frame analysis	of statically indetermi	nate systems.
Skills	After successful completion of this module, the students are able	o analyze state variables and to construc	t influence lines of sta	tically inderminate plane
	and spatial frame and truss structures.			
Personal Competence				
Social Competence	Students can			
	participate in subject-specific and interdisciplinary discuss	ions,		
	defend their own work results in front of others			
	 promote the scientific development of colleagues Furthermore, they can give and accept professional const 	ruotivo oritioism		
	- Tannenhore, mey can give and accept professional const	aouvo onuoisin		
Autonomy	The students are able to work in-term homework assignments.	Due to the in-term feedback, they are e	nabled to self-assess	s their learning progress
	during the lecture period, already.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program, 7 semester): Sp		ry	
	Civil- and Environmental Engineering: Core qualification: Compu	•	nnulcory	
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp			
	actional Engineering deterior (English program, 7 semester). Sp	Sandard Civil Engineering. Compulsor	J	

Course L0673: Structural Analysis I	l
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Uwe Starossek
Language	DE
Cycle	SoSe
Content	 Linear structural analysis: statically indeterminate systems force method slope-deflection method for sway and non-sway frames general displacement method and finite element method
Literature	Krätzig, W. B.; Harte, R.; Meskouris, K.; Wittek, U.: Tragwerke 2 - Theorie und Berechnungsmethoden statisch unbestimmter Stabtragwerke, 4. Auflage, Berlin, 2004



Course L0674: Structural Analysis I	
Тур	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Uwe Starossek
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0611: Steel Struc	tures I			
Courses				
Title		Тур	Hrs/wk	CP
Steel Structures I (L0299)		Lecture	2	3
Steel Structures I (L0300)		Recitation Section (large)	2	3
Module Responsible	Dr. Jürgen Priebe			
Admission Requirements	none			
Recommended Previous	Structural analysis I, Structural analysis II			
Knowledge	Mechanics I, Mechanics II			
	Building Materials and Building Chemistry			
	Principles of Building Materials and Building Physics			
	Finiciples of building Materials and building Physics			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	After passing this module students are able to			
	give a summary of the security concept			
	explain the priciples of the design process			
	describe and illustrate the bhaviour of memers in tension,	compression and bending		
Skills	Students can rate and apply the material steel appropiately with re	espect to its properties and usage.		
	They can use the security concept with respect to loads, forces an	d resistances.		
	They can check the ultimate limit state and the serviceability of sin	aple members in tension, compression an	d bending.	
Personal Competence				
Social Competence	After participation of an optional course (building of a simple true	ss) they are able to organize themselves	in groups. They will	be successful in guided
	building a truss with bolted connections according to design draw	ngs.		
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation (Civil- and Enviromental Engeneering: Cor	npulsory	
Curricula	General Engineering Science (German program, 7 semester): Spe	ecialisation Civil Engineering: Compulsor	у	
	Civil- and Environmental Engineering: Core qualification: Compul	sory		
	General Engineering Science (English program): Specialisation C	ivil- and Enviromental Engeneering: Com	npulsory	
	General Engineering Science (English program, 7 semester): Spe	cialisation Civil Engineering: Compulsory	1	

Course L0299: Steel Structures I	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dozenten des SD B, Prof. Uwe Starossek
Language	DE
Cycle	WiSe
Content	Introduction to steel constructions Materials Design and security model Tension rods Beams (elsatic and plastic design Column design Bolted connections
Literature	Petersen, C.: Stahlbau, 4. Auflage 2013, Springer-Vieweg Verlag Wagenknecht, G.: Stahlbau-Praxis nach Eurocode 3, Bauwerk-Verlag 2011 Band 1 Tragwerksplanung, Grundlagen Band 2 Verbindungen und Konstruktionen



Course L0300: Steel Structures I	
Тур	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dozenten des SD B
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Title	Module M0728: Hydraulic E	ingineering I			
Title Section Section					
Hydrology (10909) Hydrology (10909) Hydrology (10956) Hydrology (1					
Protein Personal Competence Social Compete					
Pydronechanics (L0615) Lecture 2 2 2 Pydronechanics (L0616) Pydronechanics (L1016) Pyd				•	
Module Responsible Module Responsible Admission Requirements Recommended Previous Recommended Previous Knowledge Mathematics I, II and III Educational Objectives Professional Competence Knowledge The students are able to define the basic terms of hydromechanics and hydrology and water management. They are able to derive the basic formulation of 1) hydrostatics, ii) kinematics of flows and iii) conservation laws and to describe and quantity the relevant processes of the hydrological water cycle Besides, the students are able to define the basic terms of hydromechanics and hydrology and water management. They are able to derive the basic formulation of 1) hydrostatics, ii) kinematics of flows and iii) conservation laws and to describe and quantity the relevant processes of the hydrological water cycle Besides, the students are able to apply the fundamental formulations of hydromechanics to basic practical problems. Besides this, they are able to apply be shydrological approaches and methods to simple hydrological problems. The students have the capability to exemplarily apply simple reservoir/storage models and a unit-hydrograph to given problems. In addition, the basic concepts of field — measurements of hydrological and hydrodynamic values can be described and the students are able to perform analyze and assess respective measurements. Personal Competence Social Competence Autonomy Students can provide each other with feedback and suggestions on their results. They are capable of reflecting their study techniques and learning strategy on an individual basis. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points Examination duration and scale Examination of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and the students are sheld to perform an analyze and assess the content of the examination includes tasks with respect to the general understanding of the lecture contents and the studen					
Module Responsible Prof. Peter Fröhle Admission Requirements Recomended Previous Knowledge Mechanik I und II Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge Knowledge The students are able to define the basic terms of hydromechanics and hydrology and water management. They are able to derive the basic formulation of I) hydrostatics, ii) kinematics of if lows and iii) conservation laws and to describe and quantify the relevant processes of the hydrological water cycle Besides, the students can describe the main aspects of rainfall-run-off-modelling and of established reservoir / storage models as well as the concepts of the determination of a unit-hydrograph. Skills The students are able to apply the fundamental formulations of hydromechanics to basic practical problems. Besides this, they are able to apply basi hydrological approaches and methods to simple hydrological problems. The students have the capability to exemplarily apply simple reservoir/storage models and a unit-hydrograph to given problems. In addition, the basic concepts of field – measurements of hydrological and hydrodynamic values can be described and the students are able to perform analyze and assess respective measurements. Personal Competence Social Competence Social Competence The students are able to prepare and present technical presentations for given topics in groups. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points 6 Examination Examination duration and scale Examination duration and scale The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and the standard of the contents and the standard of the scale contents					
Admission Requirements Recommended Previous Knowledge Educational Objectives Professional Competence Knowledge The students are able to define the basic terms of hydronechanics and hydrology and water management. They are able to derive the basic formulation of a unit-hydrograph to given problems. The students in a unit-hydrograph to given problems. The students have the capability to exemplarily apply simple reservoir/storage models and a unit-hydrograph to given problems. In addition, the basic concepts of field – measurements of hydrological and hydrodynamic values can be described and the students are able to perform analyze and assess respective measurements. Personal Competence Social Campetence Social Campetence Social Campetence Social Campetence Newtood in Hours Students are able to prepare and present technical presentations for given topics in groups. The students are able to prepare and present technical presentations for given topics in groups. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points Written exam In deviation of the examination is 2 hours. The examination includes tasks with respect to the general understand		Prof. Peter Fröhle		•	
Educational Objectives After taking part successfully, students have reached the following learning results		none			
Educational Objectives Professional Competence Knowledge The students are able to define the basic terms of hydromechanics and hydrology and water management. They are able to derive the basic formulation of i) hydrostatics, ii) kinematics of flows and iii) conservation laws and to describe and quantify the relevant processes of the hydrological water cycle Besides, the students can describe the main aspects of rainfall-run-off-modelling and of established reservoir / storage models as well as the concepts of the determination of a unit-hydrograph. Skills The students are able to apply the fundamental formulations of hydromechanics to basic practical problems. Besides this, they are able to apply basi hydrological approaches and methods to simple hydrological problems. The students have the capability to exemplarily apply simple reservoir/storage models and a unit-hydrograph to given problems. In addition, the basic concepts of field — measurements of hydrological and hydrodynamic values can be described and the students are able to perform analyze and assess respective measurements. Personal Competence Social Competence The students are able to prepare and present technical presentations for given topics in groups. Autonomy Students can provide each other with feedback and suggestions on their results. They are capable of reflecting their study techniques and learning strategy on an individual basis. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points Examination duration and scale Examination duration and scale The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and the students and scale and the scale	Recommended Previous	Mathematics I, II and III			
Professional Competence Knowledge The students are able to define the basic terms of hydromechanics and hydrology and water management. They are able to derive the basic formulation of i) hydrostatics, ii) kinematics of flows and iii) conservation laws and to describe and quantify the relevant processes of the hydrological water cycle Besides, the students can describe the main aspects of rainfall-run-off-modelling and of established reservoir / storage models as well as the concepts of the determination of a unit-hydrograph. Skills The students are able to apply the fundamental formulations of hydromechanics to basic practical problems. Besides this, they are able to apply basi hydrological approaches and methods to simple hydrological problems. The students have the capability to exemplarily apply simple reservoir/storage models and a unit-hydrograph to given problems. In addition, the basic concepts of field — measurements of hydrological and hydrodynamic values can be described and the students are able to perform analyze and assess respective measurements. Personal Competence Social Competence The students are able to prepare and present technical presentations for given topics in groups. Workload in Hours In dependent Study Time 110, Study Time in Lecture 70 Credit points Examination Examination duration and scale The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and	Knowledge	Mechanik I und II			
Professional Competence Knowledge The students are able to define the basic terms of hydromechanics and hydrology and water management. They are able to derive the basic formulation of i) hydrostatics, ii) kinematics of flows and iii) conservation laws and to describe and quantify the relevant processes of the hydrological water cycle Besides, the students can describe the main aspects of rainfall-run-off-modelling and of established reservoir / storage models as well as the concepts of the determination of a unit-hydrograph. Skills The students are able to apply the fundamental formulations of hydromechanics to basic practical problems. Besides this, they are able to apply basi hydrological approaches and methods to simple hydrological problems. The students have the capability to exemplarily apply simple reservoir/storage models and a unit-hydrograph to given problems. In addition, the basic concepts of field – measurements of hydrological and hydrodynamic values can be described and the students are able to perform analyze and assess respective measurements. Personal Competence Social Competence The students are able to prepare and present technical presentations for given topics in groups. Workload in Hours In dependent Study Time 110, Study Time in Lecture 70 Credit points Examination Examination duration and scale The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and	Educational Objectives	After taking part successfully, students have reached the foll	owing learning results		
Knowledge The students are able to define the basic terms of hydromechanics and hydrology and water management. They are able to derive the basic formulation of i) hydrostatics, ii) kinematics of flows and iii) conservation laws and to describe and quantify the relevant processes of the hydrological water cycle Besides, the students can describe the main aspects of rainfall-run-off-modelling and of established reservoir / storage models as well as the concepts of the determination of a unit-hydrograph. Skills The students are able to apply the fundamental formulations of hydromechanics to basic practical problems. Besides this, they are able to apply basi hydrological approaches and methods to simple hydrological problems. The students have the capability to exemplarily apply simple reservoir/storage models and a unit-hydrograph to given problems. In addition, the basic concepts of field — measurements of hydrological and hydrodynamic values can be described and the students are able to perform analyze and assess respective measurements. Personal Competence Social Competence Autonomy Students can provide each other with feedback and suggestions on their results. They are capable of reflecting their study techniques and learning strategy on an individual basis. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points 6 Examination Written exam Examination duration and scale The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and the students and scale to the general understanding of the lecture contents and the students and scale the students and scale the students are able to apply the fundamental formulations of hydromechanics to basic practical problems. The duration of the examination includes tasks with respect to the general understanding of the lecture contents and the students are able to apply the fundamental formulations of the determination in cludes tasks with respect t	•	2.	-		
hydrological approaches and methods to simple hydrological problems. The students have the capability to exemplarily apply simple reservoir/storage models and a unit-hydrograph to given problems. In addition, the basic concepts of field – measurements of hydrological and hydrodynamic values can be described and the students are able to perform analyze and assess respective measurements. Personal Competence Social Competence The students are able to prepare and present technical presentations for given topics in groups. Autonomy Students can provide each other with feedback and suggestions on their results. They are capable of reflecting their study techniques and learning strategy on an individual basis. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points 6 Examination duration and scale The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and	Knowledge	of i) hydrostatics, ii) kinematics of flows and iii) conservation. Besides, the students can describe the main aspects of rain	n laws and to describe and quantify the rele	vant processes of the	hydrological water cycle.
Social Competence The students are able to prepare and present technical presentations for given topics in groups. Autonomy Students can provide each other with feedback and suggestions on their results. They are capable of reflecting their study techniques and learning strategy on an individual basis. Workload in Hours Independent Study Time 110, Study Time in Lecture 70 Credit points Examination Written exam The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and	Skills	hydrological approaches and methods to simple hydrologic models and a unit-hydrograph to given problems. In addition, the basic concepts of field – measurements of hydrograph.	al problems. The students have the capabilit	y to exemplarily apply	r simple reservoir/storage
Credit points 6 Examination Written exam Examination duration and scale The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and	Social Competence	Students can provide each other with feedback and sugge		reflecting their study	techniques and learning
Examination Written exam Examination duration and scale The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and	Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Examination duration and scale The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and	Credit points	6			
	Examination	Written exam			
and the first test of the firs	Examination duration and scale	The duration of the examination is 2 hours. The examina	tion includes tasks with respect to the gene	ral understanding of	the lecture contents and
calculations tasks.		calculations tasks.			
Assignment for the Following General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory	Assignment for the Following	General Engineering Science (German program): Specialisa	ation Civil- and Enviromental Engeneering: Co	ompulsory	
Curricula General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	Curricula	General Engineering Science (German program, 7 semeste	r): Specialisation Civil Engineering: Compulso	ory	
Civil- and Environmental Engineering: Core qualification: Compulsory		Civil- and Environmental Engineering: Core qualification: Co	ompulsory		
General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory		General Engineering Science (English program): Specialisa	tion Civil- and Enviromental Engeneering: Co	mpulsory	
General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory					

Course L0909: Hydrology	
Тур	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	Introduction to basics of Hydrology:
	Hydrological cycle Data acquisition Data analyses and statistical assessment Statistics of extremes Regionalization methods for hydrological values Rainfall-run-off modelling on the basis of a unit hydrograph conceps
Literature	Maniak, Hydrologie und Wasserwirtschaft, Eine Einführung für Ingenieure, Springer
	Skript Hydrologie und Gewässerkunde



Course L0956: Hydrology	
Тур	Problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	Introduction to basics of Hydrology:
	Hydrological cycle Data acquisition Data analyses and statistical assessment Statistics of extremes Regionalization methods for hydrological values Rainfall-run-off modelling on the basis of a unit hydrograph conceps
Literature	Maniak, Hydrologie und Wasserwirtschaft, Eine Einführung für Ingenieure, Springer Skript Hydrologie und Gewässerkunde

Course L0615: Hydromechanics	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	Fundamentals of Hydromechanics
l Hoveburg	Christ aux Vorleauge Hydrogenbasik/Hydroulik Kenitel 1 0
Literature	Skript zur Vorlesung Hydromechanik/Hydraulik, Kapitel 1-2 E-Learning Werkzeug: Hydromechanik und hydraulik (Link): (http://www.tu-harburg.de/ hydraulik_tool/index.html) Truckenbrodt, E.: Lehrbuch der angewandten Fluidmechanik, Springer Verlag, Berlin, 1998. Truckenbrodt, E.: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide / Fluidmechanik, Springer Verlag, Berlin, 1996.

Course L0616: Hydromechanics	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



courses			
itle	Тур Н	lrs/wk	СР
stroduction to Control Systems (L0654)	Lecture 2		4
troduction to Control Systems (L0655)	Recitation Section (small) 2		2
Module Responsible	Prof. Herbert Werner		
Admission Requirements	none		
Recommended Previous	Representation of signals and systems in time and frequency domain, Laplace transform		
Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	 Students can represent dynamic system behavior in time and frequency domain, and can in particular explain 	n properties of	f first and second orc
	systems	p. op o oo o.	. morana accona ara
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency.	response and	d root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.		
	They can explain the role of the phase margin in analysis and synthesis of control loops		
	They can explain the way a PID controller affects a control loop in terms of its frequency response		
	They can explain issues arising when controllers designed in continuous time domain are implemented digit.	ally	
Skills			
SKIIIS	Students can transform models of linear dynamic systems from time to frequency domain and vice versa		
	They can simulate and assess the behavior of systems and control loops		
	They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules		
	They can analyze and synthesize simple control loops with the help of root locus and frequency response technique.		
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digitations of controllers designed in continuous-time and use it for digitations.	ital implement	ation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks		
Personal Competence			
Social Competence	Students can work in small groups to jointly solve technical problems, and experimentally validate their controller de	signs	
Autonomy	Students can obtain information from provided sources (lecture notes, software documentation, experiment guid	des) and use	it when solving giv
	problems.		
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Workload in Hours Credit points			
	6		
Credit points	6 Written exam		
Credit points Examination	6 Written exam 120 min		
Credit points Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineerin	atronics: Comp	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome	atronics: Comp	pulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome	atronics: Comp chanics: Com it Systems Eng	pulsory jineering: Compulso
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf	atronics: Comp chanics: Com it Systems Eng	pulsory jineering: Compulso
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf	atronics: Comp chanics: Com it Systems Eng Materials in E	pulsory jineering: Compulso Engineering Science
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory	atronics: Comp chanics: Com it Systems Eng Materials in E	pulsory jineering: Compulso Engineering Science
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory jineering: Compulso Engineering Science schanical Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory jineering: Compulso Engineering Scienc schanical Engineeri
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulsor Engineering Scienc chanical Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerin	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulso Engineering Scienc chanical Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energi Bioprocess Engineering: Core qualification: Compulsory	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulso Engineering Scienc chanical Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialis	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulso Engineering Scienc chanical Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulsor Engineering Scienc chanical Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Energy and Environmental Engineering: Core qualification: C	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulsor Engineering Scienc chanical Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Benering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus En	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulsor Engineering Scienc chanical Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Energy and Environmental Engineering: Core qualification: C	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulsor Engineering Scienc chanical Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Berdy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering. Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Pro Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Energy and Environmental Engineering: Core qualification: Comp	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulsor Engineering Scienc chanical Engineeri
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraf General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (En	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulsor Engineering Scienc chanical Engineeri
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micrat General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircrat General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus T Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulsor Engineering Scienc chanical Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biome General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energientory Science: Specialisation Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Deproc	atronics: Comp chanics: Comp it Systems Eng Materials in E heoretical Me	pulsory ineering: Compulso Engineering Science chanical Engineerin



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Aircraft\ Systems\ Engineering:\ Compulsory$

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems
	Linear systems, differential equations and transfer functions
	First and second order systems, poles and zeros, impulse and step response
	Stability
	Feedback systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Root locus techniques
	Root locus plots
	Root locus design of PID controllers
	Frequency response techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation
	Frequency response interpretation of PID control
	Time delay systems
	Root locus and frequency response of time delay systems
	Smith predictor
	Digital control
	Sampled-data systems, difference equations
	Tustin approximation, digital implementation of PID controllers
	Tustin approximation, digital implementation of PID controllers
	Software tools
	Introduction to Matlab, Simulink, Control toolbox
	Computer-based exercises throughout the course
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010



Course L0655: Introduction to Control Systems	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0628: Water Mana	agement			
Courses				
Title		Тур	Hrs/wk	СР
Groundwater Hydrology (L0251)		Lecture	1	1
Groundwater Hydrology (L0252)		Recitation Section (large)	1	2
Water Management and Water Quality (LC	366)	Lecture	2	3
Module Responsible	Prof. Wilfried Schneider			
Admission Requirements	none			
Recommended Previous	Mathemaics I to III; Water Engineering I, Chemistry			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follo	wing learning results		
Professional Competence				
Knowledge	Students are able to define terms of the hydrologic cycle and	d also parameters to identify the water qualit	y. Typical aquifer typ	es and the occuring flow
	and storage processes can be explained technically. They a	and storage processes can be explained technically. They are able to derive the Darcy law and the mathematical description of flow processes as well		of flow processes as well
	as their solution. They are in a position to explain the physica	I background of well hydraulics. Fundamental	s of solute transport	can be reflected.
Skills	Students are able to use fundamental relationships of hydrolo	ogy and water management for the solution o	f practical issues. The	ey are in a position to rate
	water quality data and to set up hydrological water balances.	They are able to construct ground water cont	our lines and stream	lines on the basis of head
	data. They have the ability to analyse data of hydraulic field a	data. They have the ability to analyse data of hydraulic field and lab tests to determine hydraulic conductivities and storage coefficients.		ficients.
Personal Competence				
Social Competence	Students are able to help each other solving case studies.			
Autonomy	Are not imparted in this module.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points				
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program, 7 semester)	: Specialisation Civil Engineering: Elective Co	ompulsory	
Curricula	Civil- and Environmental Engineering: Core qualification: Cor	mpulsory		
	General Engineering Science (English program, 7 semester):	Specialisation Civil Engineering: Elective Co	mpulsory	

Course L0251: Groundwater Hydrol	ourse L0251: Groundwater Hydrology	
Тур	Lecture	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Wilfried Schneider	
Language	DE	
Cycle	WiSe	
Content	Hydrologic water bilance, aquifertyps, groundwater velocities, Darcy law, groundwater contour lines, storage capacity, flow equation, pumping tests,	
	method of Beyer, solute transport in groundwater	
Literature	Todd; K. (2005): Groundwater Hydrology	
	Fetter, C.W. (2001): Applied Hydrogeology	
	Hölting & Coldewey (2005): Hydrogeologie	
	Charbeneau, R.J. (2000): Groundwater Hydraulics and pollutant Transport	

Course L0252: Groundwater Hydrology	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Wilfried Schneider
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L0366: Water Management	Course L0366: Water Management and Water Quality	
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Mathias Ernst	
Language	DE	
Cycle	WiSe	
Content	The lecture water Management and water quality provides knowledge on the local and global water cycle. Content overview:	
	Water balance, water availability , water scarcity, water recycling	
	Water quality parameter (organic, inorganic), assessment and decision support tools.	
Literature	Teil Wasserwirtschaft:	
	Wasserwirtschaft, Maniak, Ulrich., Berlin [u.a.]: Springer, 2001 Wasser; Grohmann, Andreas N Berlin [u.a.]: de Gruyter, 2011 Pdf der Vorlesung	



Courses				
itle	Тур		Hrs/wk	CP
computer Engineering (L0321) computer Engineering (L0324)	Lecture Recitation Section (s	small)	1	4 2
Module Responsible		,		
Admission Requirements				
Recommended Previous				
Knowledge			or to the efellowing	
	The successful completion of the labs will be honored during the evaluation of the module's ex	amination accordin	g to the followin	ig rules:
	1. Upon a passed module examination, the student is granted a bonus on the exam	ination's marks due	to the succes	sful labs, such that t
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.			
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge	This module deals with the foundations of the functionality of computing systems. It covers	the layers from the	assembly-leve	I programming down
	gates. The module includes the following topics:			
	Introduction			
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, or combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, or combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, or combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, or combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, or combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, or combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, or combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, and the supplication of the	combinational netw	orks	
	Sequential logic: Flip-flops, automata, systematic hardware design			
	Technological foundations			
	Computer arithmetic: Integer addition, subtraction, multiplication and division			
	Basics of computer architecture: Programming models, MIPS single-cycle architecture,	pipelining		
	Memories: Memory hierarchies, SRAM, DRAM, caches New York and Work and the CRIL painting of a position data as int to be a single data.			
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-po	om connections, bu	sses	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identif	fy the internal struc	cture and the p	ohysical composition
	computer systems. The students can analyze, how highly specific and individual computer	rs can be built bas	sed on a collec	ction of few and simp
	components. They are able to distinguish between and to explain the different abstraction lay	ers of today's comp	outing systems -	from gates and circu
	up to complete processors.			
	After successful completion of the module, the students are able to judge the interdependence	ies between a phys	sical computer s	system and the softwa
	executed on it. In particular, they shall understand the consequences that the execution of so	ftware has on the h	ardware-centric	abstraction layers from
	the assembly language down to gates. This way, they will be enabled to evaluate the impact the	hat these low abstra	action levels hav	ve on an entire eveter
				ve on an entire system
	performance and to propose feasible options.			ve on an entire system
Personal Competence				ve on an entire system
Personal Competence Social Competence				ve on an entire system
Social Competence	Students are able to solve similar problems alone or in a group and to present the results acco	ordingly.		ve on an entire system
	Students are able to solve similar problems alone or in a group and to present the results acco	ordingly.		ve on an entire system
Social Competence	Students are able to solve similar problems alone or in a group and to present the results acco	ordingly.		ve on an entire system
Social Competence Autonomy	Students are able to solve similar problems alone or in a group and to present the results acco Students are able to acquire new knowledge from specific literature and to associate this know Independent Study Time 124, Study Time in Lecture 56	ordingly.		ve on an entire system
Social Competence Autonomy Workload in Hours	Students are able to solve similar problems alone or in a group and to present the results acco Students are able to acquire new knowledge from specific literature and to associate this know Independent Study Time 124, Study Time in Lecture 56	ordingly.		ve on an entire system
Social Competence Autonomy Workload in Hours Credit points	Students are able to solve similar problems alone or in a group and to present the results acco Students are able to acquire new knowledge from specific literature and to associate this know Independent Study Time 124, Study Time in Lecture 56	ordingly.		ve on an entire system
Social Competence Autonomy Workload in Hours Credit points Examination	Students are able to solve similar problems alone or in a group and to present the results acconstudents are able to acquire new knowledge from specific literature and to associate this knowledge from specific literature a	ordingly.		ve on an entire system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from specific literat	rdingly. rledge with other cla		vo on an online system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from specific literat	ordingly. vledge with other classification of the classification	isses.	vo on an onino system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from specific literat	ce: Compulsory neering: Compulsory	isses.	vo on an onino system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from specific literat	ce: Compulsory neering: Compulsory se: Compulsory	isses.	vo on an onitio system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from specific literat	ce: Compulsory neering: Compulsory compulsory compulsory compulsory compulsory compulsory compulsory	isses.	ve on an entire system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from specific literat	ce: Compulsory neering: Compulsory g: Compulsory	y	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from specific literat	ce: Compulsory neering: Compulsory g: Compulsory ering: Compulsory ering: Compulsory neering: Compulsory neering: Compulsory	y	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from the specific literature and to associate this knowledge from specific lit	ce: Compulsory neering: Compulsory g: Compulsory pering: Compulsory rering: Compulsory rering: Compulsory remental Engineering: Compulsory	y y ng: Compulsory	,
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from specific literat	ce: Compulsory neering: Compulsory ge: Compulsory ge: Compulsory neering: Compulsory	y y ng: Compulsory	ipulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from the specific literature and to associate this knowledge from specific lit	ce: Compulsory neering: Compulsory rering: Compulsory rering: Compulsory remental Engineering romental Engineering romental Engineering romental Focus Mec neering, Focus Mec neering, Focus Bior	y y ng: Compulsory chatronics: Com	ipulsory mpulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from specific literat	ce: Compulsory neering: Compulsory rering: Compulsory rering: Compulsory rering: Compulsory remental Engineering romental Engineering romental Engineering romeoring, Focus Mec neering, Focus Airco	y y ng: Compulsory chatronics: Com nechanics: Con raft Systems En	pulsory mpulsory gineering: Compulso
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from Letture 56 6	ce: Compulsory neering: Compulsory rering: Compulsory rering: Compulsory rering: Compulsory remental Engineering romental Engineering romental Engineering romeoring, Focus Mec neering, Focus Airco	y y ng: Compulsory chatronics: Com nechanics: Con raft Systems En	pulsory mpulsory gineering: Compulso
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from Letture 56 6	ce: Compulsory neering: Compulsory re: Compulsory re: Compulsory re: Compulsory re: Compulsory rering: Compulsory neering: Com	y y ng: Compulsory chatronics: Com mechanics: Con raft Systems En	npulsory npulsory npulsory ngineering: Compulso Engineering Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according Students are able to acquire new knowledge from specific literature and to associate this knowledge from specific literat	ce: Compulsory neering: Compulsory rering: Compulsory rering: Compulsory rering: Compulsory rering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering, Focus Mec neering, Focus Airc Engineering, Focus Engineering, Focus	y y shatronics: Com mechanics: Con raft Systems En is Materials in	npulsory npulsory ngineering: Compulso Engineering Scienc lechanical Engineerin
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according Students are able to acquire new knowledge from specific literature and to associate this knowledge from program, 7 semester): Specialisation Nechanical Engineering Science (Germ	ce: Compulsory neering: Compulsory rering: Compulsory rering: Compulsory rering: Compulsory rering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering, Focus Mec neering, Focus Airc Engineering, Focus Engineering, Focus	y y shatronics: Com mechanics: Con raft Systems En is Materials in	npulsory npulsory ngineering: Compulso Engineering Scienc lechanical Engineerin
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according Students are able to acquire new knowledge from specific literature and to associate this knowledge from program, 7 semester): Specialisation Mechanical Engineeria Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 s	ce: Compulsory neering: Compulsory re: Compulsory re: Compulsory re: Compulsory re: Compulsory rering: Compulsory rering: Compulsory neering: Comp	y y chatronics: Com mechanics: Com raft Systems En is Materials in i: Theoretical M	npulsory npulsory ngineering: Compulso Engineering Science lechanical Engineerin
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according Students are able to acquire new knowledge from specific literature and to associate this knowledge from program, 7 semester): Specialisation Mechanical Engingeneral Engineering Science (German program, 7 semester): Specialisation Mechanical Engingeneral Engineering Science (German program,	ce: Compulsory neering: Compulsory re: Compulsory re: Compulsory re: Compulsory re: Compulsory rering: Compulsory rering: Compulsory neering: Comp	y y chatronics: Com mechanics: Com raft Systems En is Materials in i: Theoretical M	npulsory npulsory ngineering: Compulso Engineering Scienc lechanical Engineerin
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according Students are able to acquire new knowledge from specific literature and to associate this knowledge from specific specialisation Nechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester	ce: Compulsory neering: Compulsory re: Compulsory re: Compulsory re: Compulsory re: Compulsory rering: Compulsory rering: Compulsory neering: Comp	y y chatronics: Com mechanics: Com raft Systems En is Materials in i: Theoretical M	npulsory npulsory ngineering: Compulso Engineering Scienc lechanical Engineerin
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according students are able to acquire new knowledge from specific literature and to associate this knowledge from specific specialisation Compulsory specialisation Science (German program, 7 semester): Specialisation Mechanical Engineering Scie	ce: Compulsory neering: Compulsory re: Compulsory re: Compulsory re: Compulsory re: Compulsory rering: Compulsory rering: Compulsory neering: Comp	y y chatronics: Com mechanics: Com raft Systems En is Materials in i: Theoretical M	npulsory npulsory ngineering: Compulso Engineering Scienc lechanical Engineerin
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according Students are able to acquire new knowledge from specific literature and to associate this know Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science General Engineering Science (German program, 7 semester): Specialisation Naval Architectur General Engineering Science (German program, 7 semester): Specialisation Electrical Engine General Engineering Science (German program, 7 semester): Specialisation Electrical Engine General Engineering Science (German program, 7 semester): Specialisation Biomedical Engine General Engineering Science (German program, 7 semester): Specialisation Electrical Engine General Engineering Science (German program, 7 semester): Specialisation Energy and Envi General Engineering Science (German program, 7 semester): Specialisation Process Enginee General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (German program, 7 semester): Spe	ce: Compulsory neering: Compulsory rering: Compulsory rering: Compulsory rering: Compulsory rering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering, Focus Med neering, Focus Airc Engineering, Focus Engineering, Focus ngineering, Focus ngineering, Focus	y y chatronics: Com mechanics: Com raft Systems En is Materials in i: Theoretical M	npulsory npulsory ngineering: Compulso Engineering Scienc lechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according Students are able to acquire new knowledge from specific literature and to associate this known Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science General Engineering Science (German program, 7 semester): Specialisation Naval Architectur General Engineering Science (German program, 7 semester): Specialisation Civil Engineering General Engineering Science (German program, 7 semester): Specialisation Electrical Engine General Engineering Science (German program, 7 semester): Specialisation Biomedical Engine General Engineering Science (German program, 7 semester): Specialisation Energy and Envi General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Ecince (German program, 7 semester): Specialisation Mech	ce: Compulsory neering: Compulsory neering: Compulsory rering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering, Focus Med neering, Focus Airo Engineering, Focus Engineering, Focus neering, Focus neering, Focus neering, Focus	y y chatronics: Com mechanics: Com raft Systems En s Materials in r Theoretical M Product Develo	npulsory npulsory ngineering: Compulso Engineering Scienc lechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according Students are able to acquire new knowledge from specific literature and to associate this know Independent Study Time 124, Study Time in Lecture 56 Written exam magnetic science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science General Engineering Science (German program, 7 semester): Specialisation Naval Architectur General Engineering Science (German program, 7 semester): Specialisation Civil Engineering General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering Science (German program, 7 semester): Specialisation Biomedical Engine General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineerial Engineering Science (German program, 7 semester): Specialisation Energy and Envi General Engineering Science (German program, 7 semester): Specialisation Process Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Engineering Science (English program, 7	ce: Compulsory neering: Compulsory neering: Compulsory rering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering, Focus Med neering, Focus Airo Engineering, Focus Engineering, Focus neering, Focus neering, Focus neering, Focus neering, Focus neering, Focus	y y chatronics: Com mechanics: Com raft Systems En s Materials in r Theoretical M Product Develo	npulsory npulsory ngineering: Compulso Engineering Scienc lechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results according Students are able to acquire new knowledge from specific literature and to associate this known Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science General Engineering Science (German program, 7 semester): Specialisation Naval Architectur General Engineering Science (German program, 7 semester): Specialisation Civil Engineering General Engineering Science (German program, 7 semester): Specialisation Electrical Engine General Engineering Science (German program, 7 semester): Specialisation Biomedical Engine General Engineering Science (German program, 7 semester): Specialisation Energy and Envi General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Ecince (German program, 7 semester): Specialisation Mech	ce: Compulsory neering: Compulsory neering: Compulsory remering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering, Focus Med neering, Focus Airo Engineering, Focus Engineering, Focus neering, Focus	y y chatronics: Com mechanics: Com raft Systems En s Materials in r Theoretical M Product Develo	inpulsory inpulsory ingineering: Compulsor Engineering Science lechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results acconstituted students are able to acquire new knowledge from specific literature and to associate this knowledge from the specific literature and to associate this knowledge from the specific literature and to associate this knowledge from specific literature and to associate this knowledge from the specific literature and to associate this knowledge from the specific literature and to associate this knowledge from the specific literature and to associate this knowledge from specialisation. Computer Sciencial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Science (English program, 7 semester): S	ce: Compulsory neering: Compulsory neering: Compulsory remental Engineering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Compulsory neering: Focus Median Focus neering, Focus Focus Engineering, Focus neering, Focus ec: Compulsory neering: Compulsory	y y chatronics: Com mechanics: Com raft Systems En s Materials in r Theoretical M Product Develo	npulsory npulsory ngineering: Compulso Engineering Scienc lechanical Engineerin

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Computational Science and Engineering: Core qualification: Compulsory
Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	ng
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	Introduction Combinational Logic Sequential Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005.

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0631: Concrete S	tructures II			
Courses				
Title		Тур	Hrs/wk	CP
Project Concrete Structures II (L0894)		Project Seminar	1	1
Concrete Structures II (L0348)		Lecture	3	4
Concrete Structures II (L0349)		Recitation Section (large)	1	1
Module Responsible	Prof. Günter Rombach			
Admission Requirements	none			
Recommended Previous				
Knowledge	Knowledge of loads on structures and combination of action	ns		
	 Basics of safety format are required. 			
	 Knowledge in design of beams and columns for ultimate lin 	nit state		
	Lecture 'Concrete Structures I'			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The students know the basic principles which arev required for de	sign of reinforced concrete structures. T	hey know the various	methods to estimate the
	member forces in simple one and two-way slabs.			
Skills	The students can design reinforced concrete structure in the	a ultimate limit etate (chear handing to	reion) and in the cervi	coability limit state (crack
	and deflection control) including detailing (anchorage and	, , , ,	sion) and in the servi	ceability lillilit state (crack
	The students can estimate the member forces of simple sla	*		
	The students can estimate the member lorces of simple star The students know the content and the layout of a structura			
	• The students know the content and the layout of a structura	i allalysis		
Personal Competence				
Social Competence	Cooperation in a project work, where they design in a team a real	concrete building and present the results	at the end.	
Autonomy				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation C	ivil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semester): Spe	cialisation Civil Engineering: Elective C	ompulsory	
	Civil- and Environmental Engineering: Core qualification: Computer	* *	• •	
	General Engineering Science (English program): Specialisation C	•	mpulsory	
	General Engineering Science (English program, 7 semester): Spe			
	Table 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	g. 2100040 00		

Course L0894: Project Concrete Structures II	
Тур	Project Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	Design of a truss structure
Literature	Skript zur Lehrveranstaltung "Stahlbetonbau II"



Course L0348: Concrete Structures	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	 Design of concrete members for shear, punching and torsion Design for serviceability limit state (durability): crack- and deflection control Detailing Introduction in the design of plates Layout and content of a structural design
Literature	 Vorlesungsumdrucke König G., Tue N.: Grundlagen des Stahlbetonbaus. Teubner Verlag, Stuttgart 1998 Zilch K., Zehetmaier G.: Bemessung im konstruktiven Betonbau. Springer Verlag, 2010 Deutscher Beton- und Bautechnikverein E.V.: Beispiele zur Bemessung von Betontragwerken nach Eurocode 2. Band 1: Hochbau, Bauverlag GmbH, Wiesbaden 2011 Dahms KH.: Rohbauzeichnungen, Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997 Grasser E., Thielen G.: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken. Deutscher Ausschuss für Stahlbeton, Heft 240, Verlag Ernst & Sohn, Berlin 1978 DIN EN 1992-1-1:2011: Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken – Teil 1: Allgemeine Bemessungsregeln für den Hochbau.

Course L0349: Concrete Structures II	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0755: Geotechnic	s II			
Courses				
Title		Тур	Hrs/wk	СР
Foundation Engineering (L0552)		Lecture	2	2
Foundation Engineering (L0553)		Recitation Section (large)	2	2
Foundation Engineering (L1494)		Recitation Section (small)	2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	none			
Recommended Previous	Modules:			
Knowledge	- Markania III			
	Mechanics I-II Contabbaics I			
	Geotechnics I			
Educational Objectives	After taking part successfully, students have reached the fe	ollowing learning results		
Professional Competence				
Knowledge	The students know the basic principles and methods which are required to verificate the stability of geotechnical structures.			
Skills	After successful completion of the module the students are able to:			
	 verificate the stability and usability of foundations, 			
	 know individual methods of ground improvement a 	and apply them in their range of application		
	 design retaining walls. 	ind apply them in their range of application,		
	• design retaining wans.			
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 Minuten			
Assignment for the Following	General Engineering Science (German program): Special	isation Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semes	ter): Specialisation Civil Engineering: Elective Co	mpulsory	
	Civil- and Environmental Engineering: Core qualification:	Compulsory		
	General Engineering Science (English program): Speciali	sation Civil- and Enviromental Engeneering: Cor	npulsory	
	General Engineering Science (English program, 7 semest	er): Specialisation Civil Engineering: Elective Co	mpulsory	

Course L0552: Foundation Engineering	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	Shallow foundations Pile foundations Ground improvement Hetaining walls Underpinning Groundwater Conservation Cut-off Walls
Literature	Vorlesung/Übung s. www.tu-harburg.de/gbt Grabe, J. (2004): Bodenmechanik und Grundbau Kolymbas, D. (1998): Geotechnik - Bodenmechanik und Grundbau Grundbau-Taschenbuch, neueste Auflage

Course L0553: Foundation Engineering	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L1494: Foundation Engineering	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0878: Application	s in Civil and Environmental Engineering			
Courses				
Title		Тур	Hrs/wk	CP
Applied Numerical Methods (L0211)		Seminar	3	3
Applied Structural Dynamics (L0791)		Lecture	2	2
AutoCAD (L1211)		Recitation Section (small)	2	3
Building Information Modeling (L1903)		Lecture	1	1
Building Information Modeling (L1904)		Recitation Section (large)	2	2
Computational Analysis of Structures (L03	370)	Lecture	1	3
Computational Analysis of Structures (L03	372)	Recitation Section (large)	1	1
ntroduction in Statitics with R (L0286)		Lecture	1	1
ntroduction in Statitics with R (L0776)		Recitation Section (large)	1	1
Principles of Geomatics (L0470)		Lecture	2	2
Principles of Geomatics (L0471)		Recitation Section (small)	2	2
Numeric and Matlab (L0125)		Laboratory Course	2	2
Practical Course in Drinking Water Chemi	stry (L1744)	Laboratory Course	1	2
Projects II (L1228)		Project Seminar	2	2
Fire Protection and Prevention (L0472)		Lecture	2	2
Module Responsible	Prof. Wilfried Schneider			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	owing learning results		
Professional Competence				
Knowledge	The students are at home doing with typical applications of the study programme.			
Skills	The students are able to use the methods that are provided during the lectures for practical questions. They are able to work in the learnt methods into new forms of application independently".			
Personal Competence Social Competence				
Autonomy	accordingly. According to the course chosen individual students can plan and document tasks and work flow for themselves or for the team.			
Workload in Hours	Depends on choice of courses			
Credit points	6			
Assignment for the Following	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering; Elective Co	mpulsorv	
Curricula	Civil- and Environmental Engineering: Core qualification: Co		,	
Garricula	General Engineering Science (English program, 7 semester)	• •	maulcon	
	General Engineering obline (English program, 7 Semester)	. oposiansation own Engineering. Liective Co	правону	



	lethods
Тур	Seminar
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Examination Form	Schriftliche Ausarbeitung
xamination duration and scale	4 schriftliche Ausarbeitungen und erfolgreiche Bearbeitung von semesterbegleitenden Vips
Lecturer	Dr. Gernod Deckelmann
Language	DE
Cycle	WiSe
	Wilde
Content	Possible methods to solve engineering problems
	Application of numerical methods
	Basic steps in the finite element method
	Requests for the geometric modell
	Linear, quadratic and cubic elements
	Minimum total potential energy formulation and verification of results
	Non-linear problems and error-estimation procedures
	Application of ANSYS to solve typical problems in the fields of civil engineering
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung
	FEM für Praktiker ISBN: 3816926851 (Kt.) ISBN: 978-3-8169-2685-6 Renningen: expert-Verl, 2007 Groth, Clemens (Müller, Günter) FEM für Praktiker ISBN: 3816918581 Renningen: Expert-Verl, 2001 Chandrupatla, Tirupathi R (Belegundu, Ashok D.; Ramesh, T.) Introduction to finite elements in engineering ISBN: 0132162741 (United States ed.) ISBN: 9780132162746 (United States ed.) ISBN: 0273763687 (International ed.) Upper Saddle River, NJ [u.a.] Prentice Hall, 2012 Gvk
	Manual Const
	Moaveni, Saeed
	Finite element analysis : theory and application with ANSYS ISBN: 0132416514 ISBN: 9780132416511
	Upper Saddle River, NJ Pearson Prentice-Hall, 2008 Gvk
	Patankar, Suhas V
	Numerical heat transfer and fluid flow
	ISBN: 0891165223
	New York [u.a.]: Hemisphere Publ. Co, 1980
	Bathe, Klaus-Jürgen (Zimmermann, Peter)
	Finite-Elemente-Methoden
	Finite-Elemente-Methoden ISBN: 3540668063 (Gb.) ISBN: 978-3-540-66806-0



Course L0791: Applied Structural D	ynamics
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Mündliche Prüfung
Examination duration and scale	15 min
Lecturer	Dr. Kira Holtzendorff
Language	DE
Cycle	WiSe
Content	worked out in order to apply them for typical issues in practice. For an effective vibration due to vibration excitations by e.g. railway traffic, operating machines oder moving people, different structural measures are presented. The lecture is completed by performing examples of vibration measurements as well as interactive dynamic experiments in the laboratory. The following topics are covered: Particular features in structural dynamics Basic terms of time-dependent excitations Free vibrations (natural frequencies) Induced vibrations Impact excitations of structures
l Harabara	Methods of amplitude reduction (vibration isolation) Introduction to soil dynamics Vibration measurements and requirements for vibration protection Vibrations induced by people
Literature	Helmut Kramer: Angewandte Baudynamik, Ernst & Sohn Verlag, 2. Auflage 2013 Christian Petersen: Dynamik der Baukonstruktionen, Vieweg Verlag, 2. Auflage von 2000

Course L1211: AutoCAD	
Тур	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Examination Form	Klausur
Examination duration and scale	90 Minuten
Lecturer	Thomas Kölzer
Language	DE
Cycle	WiSe/SoSe
Content	Designing of drawings (e. g. line, circle, arc,) Modifying of drawings (e. g. copy, mirror, extend, trim, fillet,) Applying and managing of layers Operating in Model- and Layout-Tabs Applying of Plotstyle-Manager Dimensioning of designs and structural elements Inscribing of designs and structural elements Hatching of structural elements
Literature	Ludolph, M. / Wüstefeld, J. (2011): AutoCAD 2D-Grundlagen (Skript zur Übung)



Course L1903: Building Information Modeling	
Тур	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	siehe Modulhandbuch
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	SoSe
Content	
Literature	

Course L1904: Building Information Modeling	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	siehe Modulhandbuch
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0370: Computational Analysis of Structures		
Тур	Lecture	
Hrs/wk	1	
CP	3	
Workload in Hours	Independent Study Time 76, Study Time in Lecture 14	
Examination Form	Klausur	
Examination duration and scale	60 min	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	 basics of the Finite Element Method, Spreadsheets basics of software 'SOFiSTiK' modeling of an arbitrary cross-section modeling of an arbitrary 2D truss structure incl. loads Teddy; usage of global and local variables design of a concrete section modeling of a T-beam bridge by means of a grillage system modeling and design of a rectangular slab building models 	
Literature	 Skript zu Vorlesung Tutorials von SOFiSTiK Rombach G.: Anwendung der Finite – Elemente – Methode im Betonbau. 2. Auflage. Verlag Ernst &.Sohn, Berlin, 2007 Rombach G.: Finite-Element Design of Concrete Structures. 2nd edition, ICE Publishing, London, 2011, ISBN 0 7277 32749 Rombach G.: EDV-unterstützte Berechnungen im Stahlbetonbau. in: "Stahlbetonbau aktuell 2014" (ed. Gorris A., Hegger J., Mark P.), Berlin 2014 (S. C1C.36) 	

Course L0372: Computational Analysis of Structures	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	Siehe korrespondierende Vorlesung
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses I 2000C - Industrial via Catalities with D	
Course L0286: Introduction in Statitics with R	
Тур	Lecture
Hrs/wk	1
CP Waste distance	1 Indicated Ord Track Ord Track Indicated
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale Lecturer	60 min
	Dr. Joachim Behrendt
Language	DE WiSe
Cycle	**
Content	Introduction to R
	Graphics with R
	Descriptive Statistic (Boxplot, Percentiles, outliers)
	Propability (Combinatorics, relative frequency, dependand probability)
	random numbers and distibutions (confidence interval, uniform and discrete distributions, test-distributions (t-F-X²-distribiution))
	Correlation and Regression analysis (Confidence interval of calibration curves, linearity)
	Statistic test procedures (mean value-t-Test, Chi^2-Test, F-Test)
	Analysis of variance (ANOVA, Bartlett-Test, Kruskal-Wallis Rank sum test)
	Introduction time series (tseries)
	Introduction cluster analysis (k-means)
Literature	Regionales Rechenzentrum für Niedersachsen
	Statistik mit R
	Grundlagen der Datenanalyse
	,2013
	Einführung in die Statistik mit R, Andreas Handl, Skript Uni Bielefeld
	http://www.wiwi.uni-bielefeld.de/fileadmin/emeriti/frohn/handl_grundausbildung/statskript.pdf
	und die dazugehörige Aufgabensammlung
	http://www.wiwi.uni-bielefeld.de/fileadmin/emeriti/frohn/handl_grundausbildung/statauf.pdf
	Induktive Statistik [Elektronische Ressource] : eine Einführung mit R und SPSS / Helge
	von Toutenburg, Helge 2008
	http://dx.doi.org/10.1007/978-3-540-77510-2http://dx.doi.org/10.1007/978-3-540-77510-2
	R-Referenzcard: http://cran.r-project.org/doc/contrib/Short-refcard.pdfhttp://cran.r-project.org/doc/contrib/Short-refcard.pdf
	Grafiken und Statistik in R von Andreas Plank
	Nachschlage Skript mit Beispielen: http://www.geo.fu-berlin.de/geol/fachrichtungen/pal/mitarbeiter/plank/Formeln_in_R.pdfhttp://www.geo.fu-berlin.de/geol/fachrichtungen/pal/mitarbeiter/plank/Formeln_in_R.pdf

Course L0776: Introduction in Statitics with R	
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	siehe Vorlesung
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L0470: Principles of Geomatics	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	schriftliche Ausarbeitungen zu allen fünf Übungen, ggf. Testklausur
Lecturer	Prof. Peter Andree
Language	DE
Cycle	SoSe
Content	 Overview of geomatics in general Units of measurements Generating of topographical maps Basic surveying instruments and handling Geodetic surveying lines and verification of measurements Methods of horizontal survey Components of geodetic surveying instruments Height determination Setting out points Topographical survey Directions and angles Determination of coordinates Traversing Basics on surveying and positioning with GNSS
Literature	Andree, P.: Grundlagen der Geomatik (Skript) Resnik, B. / Bill, R.: Vermessungskunde für den Planungs- Bau- und Umweltbereich, Wichmann-verlag Witte, B. / Sparla, P.: Vermessungskunde und Grundlagen der Statistik für das Bauwesen, Wichmann-Verlag Gruber, F.J. / Joeckel, R.: Formelsammlung für das Vermessungswesen, Vieweg + Teubner-Verlag

Course L0471: Principles of Geomatics	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Hausarbeit
Examination duration and scale	
Lecturer	Prof. Peter Andree
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0125: Numeric and Matlab	
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Projektarbeit
Examination duration and scale	5 Übungsaufgaben jeweils mit Testat am Ende
Lecturer	Prof. Siegfried Rump, Weitere Mitarbeiter
Language	DE
Cycle	SoSe
Content	1. Programming in Matlab 2. Numerical methods for systems of nonlinear equations 3. Basics in computer arithmetic 4. Linear and nonlinear optimization 5. Condition of problems and algorithms 6. Verified numerical results with INTLAB
Literature	Literatur (Software-Teil): 1. Moler, C., Numerical Computing with MATLAB, SIAM, 2004 2. The Math Works, Inc., MATLAB: The Language of Technical Computing, 2007 3. Rump, S. M., INTLAB: Interval Labority, http://www.ti3.tu-harburg.de 4. Highham, D. J.; Highham, N. J., MATLAB Guide, SIAM, 2005

Course L1744: Practical Course in Drinking Water Chemistry	
Laboratory Course	
1	
2	
Independent Study Time 46, Study Time in Lecture 14	
Hausarbeit	
6 Versuchsprotokolle	
Dr. Klaus Johannsen	
DE	
WiSe	
!Max.12 students!	
The students learn basic experimental work in the laboratory. The experiments give an overview about the most important chemical analysis methods of	
drinking water. This includes sampling, photometric measurement, complexometric titration as well as acid/base titration. The experiments are strongly	
related to the processes in drinking water treatment and water distribution (e. g. removal of iron and manganese, softening and conditioning).	
Instrumental analytics is not subject of this practical course.	
1. Day: Introduction, safety instructions	
2. Day: Electrical conductivity, Saturation with respect to calcite, hardness	
3. Day: Organic carbon, iron, acid and base neutralization capacity	
4. Day: Writing protocols of experiments	
5. Day: Evaluation of the protocols	
Siehe Skript.	
Gene Gript.	
See Script.	

Course L1228: Projects II	
Тур	Project Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	ca. zehnminütige Präsentation
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	Excursions to different construction and environmental projects.
Literature	keine



Course L0472: Fire Protection and Prevention	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Mündliche Prüfung
Examination duration and scale	20 min
Lecturer	Andreas Kattge
Language	DE
Cycle	SoSe
Content	 Introduction fire in residential and office buildings town planning: location of residential, office and industry areas, location of fire stations design of roads an water pipes explosions
Literature	Schneider U.: Ingenieurmethoden im baulichen Brandschutz. Expert Verlag, 2. Aufl., 2002



lodule M0829: Foundation				
Courses				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880) roject Entrepreneurship (L0882)		Lecture Problem-based Learning	3	3
Module Responsible	Prof. Christoph Ihl	1 Toblem-based Learning		
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning	g results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of many dif Marketing and Innovation, and also to Investment and Controlling. In part		nagement, from Planr	ing and Organisation
	 explain the differences between Economics and Management and field of Management 	d the sub-disciplines in Managem	nent and to name impo	rtant definitions from t
	explain the most important aspects of and goals in Management a	nd name the most important aspe	ects of entreprneurial p	rojects
	describe and explain basic business functions as production, pr			
	ressource management, information management, innovation ma	nagement and marketing		
	 explain the relevance of planning and decision making in Busin 	ess, esp. in situations under mu	Iltiple objectives and	uncertainty, and expla
	some basic methods from mathematical Finance			
	state basics from accounting and costing and selected controlling	methods.		
Skills	Students are able to analyse business units with respect to differ Entrepreneurship project in a team. In particular, they are able to	ent criteria (organization, obje	ctives, strategies etc.) and to carry out
	analyse Management goals and structure them appropriately			
	analyse organisational and staff structures of companies			
	apply methods for decision making under multiple objectives, und	er uncertainty and under risk		
	 analyse production and procurement systems and Business information 	nation systems		
	 analyse and apply basic methods of marketing 			
	select and apply basic methods from mathematical finance to pred			
	 apply basic methods from accounting, costing and controlling to p 	redefined problems		
Personal Competence				
Social Competence	Students are able to			
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepreneurship p	roject and write a coherent repor	t on the project	
	to communicate appropriately and			
	to cooperate respectfully with their fellow students.			
Autonomy	Students are able to			
	work in a team and to organize the team themselves			
	to write a report on their project.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation Electrical	al Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Comput			
	General Engineering Science (German program): Specialisation Process			
	General Engineering Science (German program): Specialisation Bioproc General Engineering Science (German program): Specialisation Energy		omnulsory	
	General Engineering Science (German program): Specialisation Civil- an	-		
	General Engineering Science (German program): Specialisation Mechan		, ,	
	General Engineering Science (German program): Specialisation Biomed	cal Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Naval A	rchitecture: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisa			
	General Engineering Science (German program, 7 semester): Specialisa		•	
	General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa			
	General Engineering Science (German program, 7 semester): Specialisa	•	•	
	General Engineering Science (German program, 7 semester): Specialisa	·	•	
	General Engineering Science (German program, 7 semester): Specialisa			
	General Engineering Science (German program, 7 semester): Specialisa			/
	General Engineering Science (German program, 7 semester): Specialisa	tion Mechanical Engineering, Foo	cus Mechatronics: Con	npulsory
	General Engineering Science (German program, 7 semester): Specialisa	-		
	General Engineering Science (German program, 7 semester): Specialisa	-	-	
	General Engineering Science (German program, 7 semester): Special	usation Mechanical Engineering	g, Focus Materials in	Engineering Science
	Compulsory General Engineering Science (German program, 7 semester): Special	isation Mechanical Engineering	Focus Theoretical N	lechanical Engineeri
	program, 7 semester). Special		,	Liigiileelii



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory

Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program); Specialisation Biomedical Engineering; Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program); Specialisation Process Engineering; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester); Specialisation Computer Science; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Course L0880: Introduction to Mana	gement
Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgang
	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008 Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003 Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006. Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001. Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008. Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005. Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008. Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Course L0882: Project Entrepreneurship	
Тур	Problem-based Learning
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,
	using their knowledge from the corresponding lecture.
	Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Module M0579: Structural D)esign			
Courses				
Title .		Тур	Hrs/wk	СР
Basics of Structural Design (L0205)		Lecture	2	1
eminar in Structural Design (L0209)		Seminar	2	4
eminar in Structural Design (L0208)		Recitation Section (large)	1	1
Module Responsible	Dr. Gernod Deckelmann			
Admission Requirements	none			
Recommended Previous	Contents of module "Principles of Building Materials	and Building Physics"		
Knowledge				
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	After attending the course students are able			
	to define the basics of building regulations la	w		
	 to specify typical building components 			
	 to distinguish different possibilities of load be 	aring behaviour and risks due to lack of stability		
	to explain the main objectivs of fire control			
Skills	After attending the course students are able			
	to evaluate development plans and to conver	t the main objectivs of building regulation laws to a a	rchitect's plan	
	 to decide which building components should 	be used to get a correcct building enevelope and a s	ufficient buidling stabi	lity
	to proof the moisture behaviour, the energy c	onsumption, the acoustic protection and the fire contr	ol of a construction	
	 to plot the results of drafts and decisions 			
Personal Competence				
Social Competence	After attending the course students are able			
Coolai Compolorico	The alone of the source of the areas			
	 to work in a team and to persent the results o 			
	 to use the feedback from other students to im 	prove the own results		
	to give a feedback to other students in a cons	structive manner		
Autonomy	After attending the course students are able			
	to control and improve their knowledge with t	he help of weeekly presentations (lecture room) and	tests (STUD.IP)	
		duce the needed knowledge and to schedule the diff		
Workload in Hours	Independent Study Time 110, Study Time in Lecture	70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 minütige Klausur (max. 40 Punkte); semesterbeg	eitende Projektarbeit (max. 60 Punkte); Klausur mind	lestens mit 4,0	
Assignment for the Following	General Engineering Science (German program. 7 s	emester): Specialisation Civil Engineering: Compulso	ory	
Curricula	Civil- and Environmental Engineering: Core qualifica		-	
		emester): Specialisation Civil Engineering: Compulso	nrv	



Course L0205: Basics of Structural	Design
Тур	Lecture
Hrs/wk	2
СР	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dr. Gernod Deckelmann
Language	DE
Cycle	SoSe
Content	
	Basics of building regulation laws
	Foundation of buildings Overland the control of the contr
	Sealing of basements facades
	• lacades • Ceilings
	Roofs
	Windows, doors and post-and-beam constructions
	Staircases
	Basics of strucural engineering design
	Structural fire prevention
	Optional tests on STUD.IP
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung
	Neumann, Dietrich (Hestermann, Ulf.; Rongen, Ludwig.; Weinbrenner, Ulrich) Frick/Knöll Baukonstructionslehre 1 / [Internet-Ressource] ISBN: 978-3-8351-9121-1 Wiesbaden: B.G. Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2006 Frick[Begr.], Otto (Knöll[Begr.], Karl.; Neumann, Dietrich.; Hestermann, Ulf.; Rongen, Ludwig.) Baukonstruktionslehre 2 / [Internet-Ressource] ISBN: 978-3-8348-9486-1 Wiesbaden: Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008 Dierks, Klaus (Wormuth, Rüdiger.) Baukonstruktion: [Einführung, Grundlagen, Gründungen, technische Ausrüstung, Wände, Geschossdecken, Treppen, Dächer, Fenster, Türen,
	Konstruktionsatlas] ISBN: 3804150454 (Gb.) ISBN: 978-3-8041-5045-4 Neuwied: Werner, 2007 Neufert, Ernst (Kister, Johannes) Bauentwurfslehre: Grundlagen, Normen, Vorschriften über Anlage, Bau, Gestaltung, Raumbedarf, Raumbeziehungen, Maße für Gebäude, Räume, Einrichtungen, Geräte mit dem Menschen als Maß und Ziel; Handbuch für den Baufachmann, Bauherrn, Lehrenden und Lernend ISBN: 978-3-8348-0732-8 (GB.) Wiesbaden: Vieweg + Teubner, 2009



	al Design
Тур	Seminar
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Dr. Gernod Deckelmann
Language	DE
Cycle	SoSe
Content	
	Constructing a small individuell building in groups of 4 persons
	 Analysing the informations and the contents of development plans and building regulation laws
	 Design of building components and approving of the functionality (sealing, facades, roofs)
	Design and approve of the funcionality of the component interconnections
	 Proofing and assessing of moisture behaviour, energy comsumption, acoustic protection and fire control
	Assessing the building stabilty
	Basics of building services
	Each week the results of different work steps are presented in oral and written form
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung
	Neumann, Dietrich (Hestermann, Ulf.; Rongen, Ludwig.; Weinbrenner, Ulrich)
	Frick/Knöll Baukonstructionslehre 1 / [Internet-Ressource]
	ISBN: 978-3-8351-9121-1
	Wiesbaden: B.G. Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2006
	Frick[Begr.], Otto (Knöll[Begr.], Karl.; Neumann, Dietrich.; Hestermann, Ulf.; Rongen, Ludwig.)
	Baukonstruktionslehre 2 / [Internet-Ressource]
	ISBN: 978-3-8348-9486-1
	Wiesbaden : Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008
	Dierks, Klaus (Wormuth, Rüdiger.)
	Baukonstruktion : [Einführung, Grundlagen, Gründungen, technische Ausrüstung, Wände, Geschossdecken, Treppen, Dächer, Fenster, T
	Konstruktionsatlas]
	ISBN: 3804150454 (Gb.) ISBN: 978-3-8041-5045-4
	Neuwied: Werner, 2007
	Schneider, Klaus-Jürgen (Goris, Alfons.; Berner, Klaus)
	Bautabellen für Ingenieure : mit Berechnungshinweisen und Beispielen ; [auf CD-ROM: Stabwerksprogramm IQ 100 B, Tools für den k
	Ingenieurbau, Fachinformationen, Normentexte]
	ISBN: 3804152287
	Neuwied : Werner, 2006
	Wendehorst, Reinhard (Wetzell, Otto W.,; Baumgartner, Herwig,; Deutsches Institut für Normung)
	Wendehorst Bautechnische Zahlentafeln
	ISBN: 978-3-8351-0055-8 ISBN: 3835100556
	Stuttgart [u.a.]: Teubner Berlin [u.a.]: Beuth, 2007
	Neufert, Ernst (Kister, Johannes)
	Bauentwurfslehre : Grundlagen, Normen, Vorschriften über Anlage, Bau, Gestaltung, Raumbedarf, Raumbeziehungen, Maße für Gebäude, Rä
	Einrichtungen, Geräte mit dem Menschen als Maß und Ziel ; Handbuch für den Baufachmann, Bauherrn, Lehrenden und Lernenden
	ISBN: 978-3-8348-0732-8 (GB.)
	Wiesbaden: Vieweg + Teubner, 2009



T	al Design
Тур	Recitation Section (large)
Hrs/wk	
СР	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Gernod Deckelmann
Language	DE
Cycle	SoSe
Content	
	Constructing a small individuell building in groups of 4 persons And also the information and the analysis of the department of the second building in groups o
	Analysing the informations and the contents of development plans and buildling regulation laws
	Design of building components and approving of the funcionality (sealing, facades, roofs) Output Design of building components and approving of the funcionality (sealing, facades, roofs)
	Design and approve of the funcionality of the component interconnections
	Proofing and assessing of moisture behaviour, energy comsumption, acoustic protection and fire control
	Assessing the building stabilty
	Basics of building services
	Each week the results of different work steps are presented in oral and written form
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung
	Neumann, Dietrich (Hestermann, Ulf.; Rongen, Ludwig.; Weinbrenner, Ulrich)
	Frick/Knöll Baukonstructionslehre 1 / [Internet-Ressource]
	ISBN: 978-3-8351-9121-1
	Wiesbaden : B.G. Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2006
	Wissbaden . B.a. Todaner Vollagy and Table and T. Mosbaden, 2000
	Frick[Begr.], Otto (Knöll[Begr.], Karl.; Neumann, Dietrich.; Hestermann, Ulf.; Rongen, Ludwig.)
	Baukonstruktionslehre 2 / [Internet-Ressource]
	ISBN: 978-3-8348-9486-1
	Wiesbaden : Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008
	Dierks, Klaus (Wormuth, Rüdiger.)
	Baukonstruktion: [Einführung, Grundlagen, Gründungen, technische Ausrüstung, Wände, Geschossdecken, Treppen, Dächer, Fenster, Ti
	Konstruktionsatlas]
	ISBN: 3804150454 (Gb.) ISBN: 978-3-8041-5045-4
	Neuwied : Werner, 2007
	Colonidae Mana Nimon (Caris Alfana Davas Mana)
	Schneider, Klaus-Jürgen (Goris, Alfons.; Berner, Klaus) Reutshallen, für Jagniquen imit Reseabeungsbigweisen, und Reispielen i fauf CD POM: Stabwerkenragramm IO 100 R. Tools für den keine
	Bautabellen für Ingenieure : mit Berechnungshinweisen und Beispielen ; [auf CD-ROM: Stabwerksprogramm IQ 100 B, Tools für den ko
	Ingenieurbau, Fachinformationen, Normentexte]
	ISBN: 3804152287
	Neuwied : Werner, 2006
	Wendehorst, Reinhard (Wetzell, Otto W.,; Baumgartner, Herwig,; Deutsches Institut für Normung)
	Wendehorst Bautechnische Zahlentafeln
	1
	ISBN: 978-3-8351-0055-8 ISBN: 3835100556
	ISBN: 978-3-8351-0055-8 ISBN: 3835100556 Stuttgart [u.a.] : Teubner Berlin [u.a.] : Beuth, 2007
	Stuttgart [u.a.]: Teubner Berlin [u.a.]: Beuth, 2007
	Stuttgart [u.a.]: Teubner Berlin [u.a.]: Beuth, 2007 Neufert, Ernst (Kister, Johannes)
	Stuttgart [u.a.]: Teubner Berlin [u.a.]: Beuth, 2007 Neufert, Ernst (Kister, Johannes) Bauentwurfslehre: Grundlagen, Normen, Vorschriften über Anlage, Bau, Gestaltung, Raumbedarf, Raumbeziehungen, Maße für Gebäude, Rä
	Stuttgart [u.a.]: Teubner Berlin [u.a.]: Beuth, 2007 Neufert, Ernst (Kister, Johannes) Bauentwurfslehre: Grundlagen, Normen, Vorschriften über Anlage, Bau, Gestaltung, Raumbedarf, Raumbeziehungen, Maße für Gebäude, Rät Einrichtungen, Geräte mit dem Menschen als Maß und Ziel; Handbuch für den Baufachmann, Bauherrn, Lehrenden und Lernenden
	Stuttgart [u.a.]: Teubner Berlin [u.a.]: Beuth, 2007 Neufert, Ernst (Kister, Johannes) Bauentwurfslehre: Grundlagen, Normen, Vorschriften über Anlage, Bau, Gestaltung, Raumbedarf, Raumbeziehungen, Maße für Gebäude, Räu



Module M0686: Sanitary En	gineering			
Courses				
Title Wastewater Disposal (L0276)		Typ Lecture	Hrs/wk	CP 2
Wastewater Disposal (L0278)		Recitation Section (large)	1	1
Drinking Water Supply (L0306)		Lecture	2	1
Drinking Water Supply (L0308)		Recitation Section (large)	1	2
Module Responsible	Prof. Ralf Otterpohl			
Admission Requirements	none			
Recommended Previous	Basic knowledge on Chemistry and Biology			
Knowledge	Hydraulics of pipe systems and open channels			
	Basic knowledge on water management: water quantity and water	quality		
	Basic knowledge on Environmental Legislation: Federal Water Act			
Educational Objectives	After taking part successfully, students have reached the following learning	results		
Professional Competence	The many part successions, successions have reached the following learning	, roduito		
Knowledge	The students can examplify their expert knowledge on urban water infrastr	uctures. They can present the derivation	on and detailed ex	rolanation of important
, wie meage	standards for the design of drinking water supply and wastewater dispo			
	empiricals assumptions and scientific simplifications. The students are able			-
	used for drinking and wastewater treatment. They can also assess existing		• .	-
	saftey aspects. Furthermore, they know how to draft the features and e	•		
	pressure membrane filtration systems and techniques for the removal of tra	ace pollutants.		
Skills	The students are able to apply the relevant standards and guidelines for the design and operation of urban water infrastructures independently. Their expertise comprises expert skills to design drinking water supply and urban drainage systems as well as the associated treatment facilities. Besides the acquirement of technical skills the students are able to address and solve biochemical problems in the filed of drinking water and wastewater treatment. The students are also able to develop ideas of their own to improve the existing water related infrastructures, systems and concepts.			
Personal Competence				
Social Competence	Students are able to form concepts on their own to optimize urban water	infrastructure processes. Therefore the	ney can acquire a	ppropriate knowledge
	when being given some clues or information with regard to the approach to	problems (preparation and follow-up	of the exercises).	
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Civil- and		•	
Curricula	General Engineering Science (German program, 7 semester): Specialisation	on Civil Engineering: Elective Compuls	sory	
	Civil- and Environmental Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Civil- and			
	General Engineering Science (English program, 7 semester): Specialisation	on Givii Engineering: Elective Compuls	sory	



Course L0276: Wastewater Disposa	ıl
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	DE
Cycle	SoSe
Content	This lecture focusses on urban drainage and wastewater treatment.
	Urban Drainage Design of urban drainage systems (combined and separate sewer systems)
	Special structures
	Rainwater management
	Wastewater treatement
	 Mechanical treatment (Screens, Grit chamber, Preliminary Sedimentation, Secondary Settlement Tanks, Membrane Filtration) Biological Treatment (aerobic, anaerobic, anoxic) Special Wastewater Treatment Processes (Ozonation, Adsorption)
Literature	
	The literature listed below is available in the library of the TUHH.
	 Taschenbuch der Stadtentwässerung: mit 10 Tafeln und 67 Tabellen, Imhoff, K., & . (2009). (31., verbesserte Aufl.). Munchen: Oldenbourg Industrieverl. Abwasser: Technik und Kontrolle. Neitzel, Volkmar, and Weinheim [u.a.]: Wiley-VCH, 1998.
	 Kommunale Kläranlagen: Bemessung, Erweiterung, Optimierung, Betrieb und Kosten, (2009). Gunthert, F. Wolfgang: (3., vollig neu bearb. Aufl.). Renningen: expert-Verl. Water and wastewater technology Hammer, M. J. 1., & . (2012). (7. ed., internat. ed.). Boston [u.a.]: Pearson Education International. Water and wastewater engineering: design principles and practice: Davis, M. L. 1. (2011) New York, NY: McGraw-Hill. Biological wastewater treatment: (2011). C. P. Leslie Grady, Jr. (3. ed.). London, Boca Raton, Fla. [u.a.]: IWA Publ.

Course L0278: Wastewater Disposal	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ralf Otterpohl
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0306: Drinking Water Supp	ıly
Тур	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dr. Klaus Johannsen, Prof. Mathias Ernst
Language	DE
Cycle	SoSe
Content	The lecture on drinking water supply provides students with a basic understanding of the entire water supply system, encompassing water catchment, water treatment including pump systems, water storage, and the distribution system that carries water to the consumer. Initially, basics in hydraulics and pump systems are presented (system curve and pump curve). Students learn how the duty point of the pump is determined. Students learn about different water resources and will be able to design groundwater wells. Students learn how to determine water demand and derive planning values for designing the different elements of a water supply system (e.g. firefighting requirements). The functions of reservoirs, their design and arrangement in the water supply system are explained. Students will be able to design simple water distribution systems. A further part of the lecture deals with the processes involved in drinking water supply. This includes a presentation of the essential mechanisms and layout parameters for sedimentation, filtration, coagulation, membrane treatment, adsorption, water softening, gas exchange, ion exchange and disinfection. The basics of process treatment technology will be built on with parallel analysis of the impacts on chemical and physical water quality parameters.
Literature	Gujer, Willi (2007): Siedlungswasserwirtschaft. 3., bearb. Aufl., Springer-Verlag. Karger, R., Cord-Landwehr, K., Hoffmann, F. (2005): Wasserversorgung. 12., vollst. überarb. Aufl., Teubner Verlag Rautenberg, J. et al. (2014): Mutschmann/Stimmelmayr Taschenbuch der Wasserversorgung. 16. Aufl., Springer-Vieweg Verlag. DVGW Lehr- und Handbuch Wasserversorgung: Wasseraufbereitung - Grundlagen und Verfahren, m. CD-ROM: Band 6 (2003).

Course L0308: Drinking Water Supply	
Тур	Recitation Section (large)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dr. Klaus Johannsen, Prof. Mathias Ernst
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Market Mooon Hadrania F	Contract of the H			
Module M0869: Hydraulic E	ingineering ii			
Courses				
Title		Тур	Hrs/wk	СР
Hydraulics (L0957)		Lecture	1	1
Hydraulics (L0958)		Recitation Section (large)	1	1
Hydraulic Engineering (L0959)		Lecture	2	2
Hydraulic Engineering (L0960)		Recitation Section (large)	1	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	none			
Recommended Previous	Hydraulik Engineering I			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the f	ollowing learning results		
Professional Competence				
Knowledge	Students are able to define the basic terms of hydraulic	engineering and hydraulics. They are able to	explain the application	n of basic hydrodynamic
	formulations (conservation laws) to practical hydraulic	engineering problems. Besides this, the stude	nts can illustrate imp	ortant tasks of hydraulic
	engineering and give an overview over river engineering,	flood protection, hydraulic power engineering a	nd waterways engine	ering.
Skills	, , , , , , , , , , , , , , , , , , ,			
	systems. Besides this, they are able to use and apply esta	, ,	e water surfaces of ch	annel flows, influences o
	constructions (weirs, etc.) on channel flows as well as flow	conditions of pipe system.		
Personal Competence				
Social Competence	The students are able to deploy their gained knowledge	e in applied problems. Additionally, they will be	able to work in tean	n with engineers of othe
•	disciplines.	3, 3		· ·
Autonomy	·	owledge and apply it to new problems.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	The duration of the examination is 2 hours. The exami	nation includes tasks with respect to the gene	ral understanding of	the lecture contents and
	calculations tasks.			
Assignment for the Following	General Engineering Science (German program): Special	isation Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semes	ster): Specialisation Civil Engineering: Elective C	ompulsory	
	Civil- and Environmental Engineering: Core qualification:	Compulsory		
	General Engineering Science (English program): Speciali	sation Civil- and Environmental Engeneering: Co	mpulsory	
	General Engineering Science (English program, 7 semes	ter): Specialisation Civil Engineering: Elective C	ompulsory	
		· · · · · · · · · · · · · · · · · · ·	<u> </u>	

Course L0957: Hydraulics	
Тур	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
	Flow of incompressible fluids in pipes and open channels Hydraulics of pipes Punps in hydraulic systems Open channel flow Regulative construction in open channel flow Weirs Sliding panels Cross-section reduction by constructions
Literature	Zanke, Ulrich C., Hydraulik für den WasserbauUrsprünglich erschienen unter: Schröder/Zanke "Technische Hydraulik", Springer-Verlag, 2003 Naudascher, E.: Hydraulik der Gerinne und Gerinnebauwerke, Springer, 1992

Course L0958: Hydraulics	Course L0958: Hydraulics	
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Peter Fröhle	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0959: Hydraulic Engineering	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	Fundamentals of hydraulic engineering
	 Introduction and hydrological cycle River engineering Regime theory of natural rivers Sediment transport Regulation of rivers Bank protection / protection of river bed Tidal rivers Flood protection Dikes Flood contraol basins Hydraulic power Inland waterways engineering waterways Locks and ship lifts Fish passages Nature-oriented hydraulic engineering
Literature	Strobl, T. & Zunic, F: Wasserbau, Springer 2006
Literature	Patt, H. & Gonsowski, P: Wasserbau, Springer 2011

Course L0960: Hydraulic Engineering	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Specialization Bioprocess Engineering

Biotechnology provides the basics for sustainable manufacturing of products as food, feed, bioenergy, biopolymers and chemicals and for providing the human being wit medicines and other essential goods. It requires interdisciplinary application of natural (especially biology and chemistry) and engineering sciences. Many everyday products are manufactured by means of biotechnical production processes. Biotechnical material conversion is also used to utilize and minimize byproducts and residues in order to achieve sustainable production. Engineers with biotechnical expertise are needed to meet the growing global demand for the development and operation of biotechnical processes by which to manufacture essential everyday products.

Graduates can explain phenomena that occur in bioprocess engineering and allied disciplines. They can outline the basic bioprocess engineering principles for interpreting, modeling, and simulating biological processes and chemical reactions, energy, material, and momentum transport processes, micro-, meso- and macro-scale separation processes, and for operating the plant required for these processes. They are able to describe the basics of measurement and control technology. They can take into consideration legal aspects that arise in connection with process engineering and production facilities.

Courses				
ïtle		Тур	Hrs/wk	CP
ntroduction into Process Engineering/Biop		Lecture	2	1
Fundamentals of material engineering (L0830) Lecture 2		2		
Module Responsible	Prof. Michael Schlüter			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ed the following learning results		
Professional Competence				
Knowledge	After passing this module the students have the ab	oility to:		
	 give an overview of the most important field 	ds on process and bioprocess engineering		
	explain some working methods for different			
		· · · · · · · · · · · · · · · · · · ·		
Skills	After passing this module the students should have	e the ability to:		
	list and outline the most important fields of	process engineering,		
		nes or methods of the different fields of process eng	aineering.	
	 read and prepare an engineering drawing, 		, 9,	
	explain the most important technologies for	r wastewater and exhaust air treatment		
		ical processes independently with the aid of pointe	ers.	
Personal Competence				
Social Competence	The students are able to			
	 work out results in groups and document the 	nem,		
		eedback on their own performance constructively.		
		,		
Autonomy		s of learning by themselves and to deliberate the	eir lack of knowledge in P	rocess Engineering a
	Bioprocess Engineering.			
Workload in Hours	Independent Study Time 34, Study Time in Lecture	56		
Credit points	3			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program):	Specialisation Process Engineering: Compulsory		
Curricula		Specialisation Bioprocess Engineering: Compulso	ry	
		7 semester): Specialisation Process Engineering: C	•	
		7 semester): Specialisation Bioprocess Engineering		
	Bioprocess Engineering: Core qualification: Comp		. , ,	
		Specialisation Bioprocess Engineering: Compulsor	γ	
	General Engineering Science (English program):		-	
		semester): Specialisation Process Engineering: Co	ompulsory	
		semester): Specialisation Bioprocess Engineering		
	Process Engineering: Core qualification: Compuls	, ,		



Course L0829: Introduction into Process Engineering/Bioprocess Engineering	
Тур	Lecture
Hrs/wk	2
СР	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dozenten des SD V
Language	DE
Cycle	WiSe
Content	Introduction into the different research fields of the subject Process Engineering and Bioprocess Engineering.
Literature	s. StudIP

Course L0830: Fundamentals of ma	terial engineering
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Marko Hoffmann
Language	DE
Cycle	WiSe
Content	 Introduction Atomic structure and bonding Structure of solids Miller indices Imperfections in solids Texture Diffusion Mechanical properties Dislocations and strengthening mechanisms Phase transformations Phase diagrams, iron-carbon phase diagram Metallic materials Corrosion Polymeric materials Ceramic materials Ceramic materials
Literature	 Bargel, HJ.; Schulze, G. (Hrsg.): Werkstoffkunde. Berlin u.a., Springer Vieweg, 2012. Bergmann, W.: Werkstofftechnik 1. München u.a., Hanser, 2009. Bergmann, W.: Werkstofftechnik 2. München u.a., Hanser, 2008. Callister, W. D.; Rethwisch, D. G.: Materialwissenschaften und Werkstofftechnik: eine Einführung, Übersetzungshrsg.: Scheffler, M., 1. Auflage, Weinheim, Wiley-VCH, 2013. Seidel, W. W., Hahn, F.: Werkstofftechnik. München u.a., Hanser, 2012.



Module M0937: Physical Cl	nemistry			
Courses				
Title		Тур	Hrs/wk	CP
Physical Chemistry (L0833) Physical Chemistry (L0835)		Lecture Laboratory Course	2	2
Module Responsible	Prof. Hans-Ulrich Moritz	Laboratory Course	2	'
Admission Requirements	None			
Recommended Previous	Contents of the previous modules inorganic chemistry, physics for	r engineers and mathematics I-III		
Knowledge	Comento of the previous modules mergame enemistry, physics is	r engineers and matternation in.		
Educational Objectives	After taking part successfully, students have reached the following	a learning results		
Professional Competence	, , , , , , , , , , , , , , , , , , , ,	5 · · · · · · · · · · · · · · · · · · ·		
Knowledge	The students are able,			
	-to repeat the basic concepts of physical chemistry			
	-to describe and summarize the underlying concepts of mass-, $ h $	eat- and momentum transfer.		
	- to interpret phase diagrams and affiliate kinetic rate laws.			
Skills	The students are able to			
	- conduct (fundamental) thermodynamical, electrochemical and l	inetic calculations.		
	- assess new applications with respect to environmental sustain	ability.		
	- abstract their knowldege to related issues to conduct thermodyl	amical, electrochemical and kinetic ca	Iculations.	
Personal Competence				
Social Competence	The students are able to plan, prepare, conduct and document e	periments according to scientific guide	elines in small groups.	
	The students are able to reflect their subject-specific knowledge	orally in a team and to discuss it with fe	llow students and faculty	<i>'</i> .
Autonomy	Students are able to assess their knowldege continuously on the	ir own by exemplified practice. Studen	nts are able to apply thei	r knowldege discretely to
	plan, prepare and conduct experiments.	,		,
Workload in Hours	Independent Study Time 34, Study Time in Lecture 56			
Credit points	3			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Specialisation		nnulcon	
	General Engineering Science (German program, 7 semester): Sp			
	Bioprocess Engineering: Core qualification: Elective Compulsor		osavo oompulaory	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): Sp		npulsory	
	General Engineering Science (English program, 7 semester): Sp			
	Process Engineering: Core qualification: Compulsory			

Course L0833: Physical Chemistry	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Hans-Ulrich Moritz, Dr. Werner Pauer
Language	DE
Cycle	WiSe
Content	State variables and state equations, ideal and real gases, first law, driving force of chemical reactions, chemical equilibria, introduction into kinetics of
	chemical reactions, introduction into transport phenomena, phase equilibria, equilibria at surfaces and interfaces
Literature	P. W. Atkins, J. de Paula: Physikalische Chemie, 5. Auflage, Wiley-VCH, 2013
	P. W. Atkins, J. de Paula: Kurzlehrbuch Physikalische Chemie, 4. Auflage, Wiley-VCH, 2008
	G. Wedler, HJ. Freund: Lehrbuch der Physikalischen Chemie, 6. Auflage, Wiley-VCH, 2012
	R. Reich: Thermodynamik - Grundlagen u. Anwendungen in der allgemeinen Chemie, 2. Auflage, Wiley-VCH, 1993
	U. Nickel: Lehrbuch der Thermodynamik - Eine verständliche Einführung, 2. Auflage, PhysChem-Verlag, 2011
<u> </u>	



Course L0835: Physical Chemistry	
Тур	Laboratory Course
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Hans-Ulrich Moritz, Dr. Werner Pauer
Language	DE
Cycle	WiSe
Content	Six laboratory experiments are conducted in groups of two students. The subjects of experimental investigations are:
	Reaction kinetics
	Freezing-point depression (cryoscopy)
	Electrical mobility of ions
	Viscosimetry
	Heat of neutralization
	Surface tension
	Before the practical conduct of the experiments a colloquium takes place in which the students explain, reflect and discuss the theoretical basics and their translation into practice.
	The students write up a report for every experiment. They receive feedback to their level of scientific writing (citation methods, labeling of graphs, etc.), so that they can improve their competence in this field over the course of the practical course.
Literature	Skript zum Chemiepraktikum III für Verfahrenstechniker, jeweils aktuelle Version, ca. 100 Seiten, PDF-Datei zum Download unter
	http://www.chemie.uni-hamburg.de/studium/nebenfach/tuhh3/studium/nebenfach/tuhh3/studium/nebenfach/tuhh3/Praktikum_2013_2014.html



Courses				
Title		Тур	Hrs/wk	CP
Computer Engineering (L0321) Computer Engineering (L0324)		Lecture Recitation Section (small)	3 1	4
Module Responsible	Prof. Heiko Falk	Heckation Section (Smail)	1	2
Admission Requirements	None			
Recommended Previous	Basic knowledge in electrical engineering			
Knowledge	Basic knowledge in electrical engineering			
	The successful completion of the labs will be honored during th	e evaluation of the module's examination ac	cording to the followi	ng rules:
	1. Upon a passed module examination, the student is g	ranted a bonus on the examination's mark	s due to the succes	ssful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively	up to the next-better grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 u	to 4,0 is not possible.		
Educational Objectives	After taking part successfully, students have reached the following	ng loarning recults		
Professional Competence	After taking part successionly, students have reached the following	ing rearring results		
Knowledge	This module deals with the foundations of the functionality of	computing systems. It covers the lavers fro	m the assembly-leve	el programming down
rthowieage	gates. The module includes the following topics:	companing systems. It covers the layers no	in the describing leve	or programming down
	gation the module modules are following topics:			
	Introduction			
	Combinational logic: Gates, Boolean algebra, Boolean to		networks	
	Sequential logic: Flip-flops, automata, systematic hardw	are design		
	Technological foundations Computer with motion lategory addition, subtraction, multi-	disation and division		
	 Computer arithmetic: Integer addition, subtraction, multiperson of computer architecture: Programming models, I 			
	Memories: Memory hierarchies, SRAM, DRAM, caches	wir 3 single-cycle architecture, pipelining		
	Input/output: I/O from the perspective of the CPU, princip	les of passing data, point-to-point connection	ns. busses	
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		.,	
Skills	The students perceive computer systems from the architect's			
	computer systems. The students can analyze, how highly sp	ecific and individual computers can be bu	ilt based on a colle	ction of few and sim
	components. They are able to distinguish between and to expl	ain the different abstraction layers of today's	computing systems	- from gates and circi
	up to complete processors.			
	After successful completion of the module, the students are ab	e to judge the interdependencies between a	a physical computer	system and the softwa
	executed on it. In particular, they shall understand the consequ	ences that the execution of software has on	the hardware-centri	c abstraction layers fr
	the assembly language down to gates. This way, they will be en	nabled to evaluate the impact that these low	abstraction levels ha	ave on an entire syste
	performance and to propose feasible options.			
Personal Competence				
Social Competence	Students are able to solve similar problems alone or in a group	and to present the results accordingly		
ociai competence	State its able to solve similar problems alone of in a group	and to present the results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific litera	ture and to associate this knowledge with ot	ner classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes, contents of course and labs			
Assignment for the Following	General Engineering Science (German program): Core qualific	ation: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): \$	Specialisation Computer Science: Compulso	ry	
	General Engineering Science (German program, 7 semester): S		-	
	General Engineering Science (German program, 7 semester): S	Specialisation Naval Architecture: Compulsor	v	
	Canaral Engineering Science (Cormon program, 7 competer):	pooranoation rearant trontoctaro. Companoo		
	General Engineering Science (German program, 7 semester).	specialisation Civil Engineering: Compulsory	•	
	General Engineering Science (German program, 7 semester): S	specialisation Civil Engineering: Compulsory	,	
		specialisation Civil Engineering: Compulsory	lsory	
	General Engineering Science (German program, 7 semester): S	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compu pecialisation Biomedical Engineering: Com	ilsory pulsory	y
	General Engineering Science (German program, 7 semester): \$General Engineering Science (German program, 7 semester): \$\footnote{General Engineering Science (General Engineering Science (German program, 7 semester): \$\footnote{General Engineering Science (General Engineering S	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compuspecialisation Biomedical Engineering: Compuspecialisation Energy and Enviromental Engopecialisation Process Engineering: Compul	llsory pulsory ineering: Compulsor sory	
	General Engineering Science (German program, 7 semester): 8	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Biomedical Engineering: Compuspecialisation Biomedical Engineering: Compulspecialisation Process Engineering: Compulspecialisation Mechanical Engineering, Focuspecialisation Mechanical Engineering Mechanical Engineerin	ulsory pulsory ineering: Compulsor sory is Mechatronics: Con	npulsory
	General Engineering Science (German program, 7 semester): 8	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compuspecialisation Biomedical Engineering: Compuspecialisation Biomedical Engineering: Compuspecialisation Energy and Enviromental Engipecialisation Process Engineering: Compul pecialisation Mechanical Engineering, Focuppecialisation Mechanical Engineering Mechanical Eng	ulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co	npulsory mpulsory
	General Engineering Science (German program, 7 semester): \$\footnote{S}\$	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compuspecialisation Biomedical Engineering: Compuspecialisation Energy and Enviromental Engipecialisation Process Engineering: Compul pecialisation Mechanical Engineering, Focupecialisation Mechanical Engineering	pulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co	npulsory mpulsory ngineering: Compulso
	General Engineering Science (German program, 7 semester): \$ Genera	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compuspecialisation Biomedical Engineering: Compuspecialisation Energy and Enviromental Engipecialisation Process Engineering: Compul pecialisation Mechanical Engineering, Focupecialisation Mechanical Engineering	pulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co	npulsory mpulsory ngineering: Compulso
	General Engineering Science (German program, 7 semester): S	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compuspecialisation Biomedical Engineering: Compuspecialisation Energy and Environmental Engipecialisation Process Engineering: Compulspecialisation Mechanical Engineering, Focuspecialisation Mechanical Engineering,	pulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co is Aircraft Systems Ei Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Scienc
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester)	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compuspecialisation Biomedical Engineering: Compuspecialisation Energy and Environmental Engipecialisation Process Engineering: Compulspecialisation Mechanical Engineering, Focuspecialisation Mechanical Engineering,	pulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co is Aircraft Systems Ei Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Scienc
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester Compulsory	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Energy and Enviromental Engineering: Compulspecialisation Process Engineering: Compulspecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Postalisation Mechanical Engineering,	pulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co is Aircraft Systems Ei Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester)	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Energy and Enviromental Engineering: Compulspecialisation Process Engineering: Compulspecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Postalisation Mechanical Engineering,	pulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co is Aircraft Systems Ei Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester) Compulsory	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Energy and Environmental Engineering: Compulsipecialisation Process Engineering: Compulsipecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Process Specialisation Mechanical Engineering, Process Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering Specialisat	pulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co is Aircraft Systems El Focus Materials in Focus Theoretical M ocus Product Devel	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): S Compulsory General Engineering Science (German program, 7 semester): S Compulsory General Engineering Science (German program, 7 semester): S Compulsory General Engineering Science (German program, 7 semester): S Compulsory	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Energy and Environmental Engineering: Compulsipecialisation Process Engineering: Compulsipecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Process Specialisation Mechanical Engineering, Process Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering Specialisat	pulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co is Aircraft Systems El Focus Materials in Focus Theoretical M ocus Product Devel	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester) Compulsory	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Energy and Environmental Engineering: Compulsipecialisation Process Engineering: Compulsipecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Process Specialisation Mechanical Engineering, Process Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering Specialisat	pulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co is Aircraft Systems El Focus Materials in Focus Theoretical M ocus Product Devel	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Energy and Environmental Engineering: Compulsive Engineering: Compulsive Engineering: Compulsive Engineering: Compulsive Engineering: Focus Pecialisation Mechanical Engineering, Focus Pecialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Engineering, Engineering: Specialisation Mechanical Engineering, Engineering, Engineering, Engineering, Engineering, Focus	pulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co is Aircraft Systems El Focus Materials in Focus Theoretical M ocus Product Devel	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester) Compulsory	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Biomedical Engineering: Compulsory pecialisation Process Engineering: Compulsory Engineering Process Engineering: Compulsory Engineering Process Engin	pulsory pulsory pulsory ineering: Compulsor sory is Mechatronics: Cor is Biomechanics: Co is Aircraft Systems Ei Focus Materials in Focus Theoretical M ocus Product Devel	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Computer Science: Core qualification: Compulsory General Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Core qualificatio	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Biomedical Engineering: Compulsory pecialisation Process Engineering: Compulsory pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Process Specialisation Mechanical Engineering, Process Specialisation Mechanical Engineering, Focus pecialisation Computer Science: Compulsory pecialisation Computer Science: Compulsory	pulsory pulsory pulsory ineering: Compulsor sory is Mechatronics: Con is Biomechanics: Co is Aircraft Systems Ei Focus Materials in Focus Theoretical M ocus Product Devel is Energy Systems: C	npulsory mpulsory ngineering: Compulso Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Computer Science: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Biomedical Engineering: Compulsory pecialisation Biomedical Engineering: Compulsory pecialisation Process Engineering: Compulsory pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Process Specialisation Mechanical Engineering, Process Specialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus pecialisation Computer Science: Compulsory pecialisation Bioprocess Engineering: Com	pulsory pulsory pulsory ineering: Compulsor sory is Mechatronics: Con is Biomechanics: Co is Aircraft Systems E Focus Materials in Focus Theoretical M ocus Product Devel is Energy Systems: C	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Computer Science: Core qualification: Compulsory General Engineering Science (English program, 7 semester): S	pecialisation Civil Engineering: Compulsory pecialisation Electrical Engineering: Compulsory pecialisation Biomedical Engineering: Compulsory pecialisation Biomedical Engineering: Compulsory pecialisation Process Engineering: Compulsory pecialisation Mechanical Engineering, Focure pecialisation Computer Science: Compulsory pecialisation Bioprocess Engineering: Compulsory pecialisation Naval Architecture: Compulsory peciali	pulsory	npulsory mpulsory ngineering: Compulso Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester) Computer Science: Core qualification: Compulsory General Engineering Science (English program, 7 semester) General Engineering Science (English program, 7 semester): S	pecialisation Civil Engineering: Compulsory specialisation Electrical Engineering: Compu- specialisation Biomedical Engineering: Compu- specialisation Energy and Enviromental Eng- specialisation Process Engineering: Compul- specialisation Mechanical Engineering, Focu- specialisation Mechanical Engineering, Focu- specialisation Mechanical Engineering, specialisation Computer Science: Compulsory specialisation Bioprocess Engineering: Compulsory specialisation Naval Architecture: Compulsory specialisation Civil Engineering: Compulsory	pulsory pulsory pulsory pulsory pulsory sineering: Compulsor sory sis Mechatronics: Con sis Biomechanics: Co sis Aircraft Systems Ei Focus Materials in Focus Theoretical M ocus Product Devel sis Energy Systems: Co y pulsory	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Computational Science and Engineering: Core qualification: Compulsory
Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering		
Тур	Lecture	
Hrs/wk	3	
CP	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Heiko Falk	
Language	DE	
Cycle	WiSe	
Content	Introduction Combinational Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output	
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005. 	

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0536: Fundament	als of Fluid Mechanics			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Fluid Mechanics (L0091)		Lecture	2	4
Fluid Mechanics for Process Engineering	L0092)	Recitation Section (large)	2	2
Module Responsible	Prof. Michael Schlüter	· -		
Admission Requirements	None			
Recommended Previous				
Knowledge	Mathematics I+II+III			
-	Technical Mechanics I+II			
	Technical Thermodynamics I+II			
	Working with force balances Cincilifaction and activities of partial differential acceptances.			
	Simplification and solving of partial differential equation	ions		
	Integration			
Educational Objectives	After taking part successfully, students have reached the following	owing learning results		
Professional Competence				
Knowledge	Students are able to:			
	explain the difference between different types of flow		-i	
	give an overview for different applications of the Rey			
	 explain simplifications of the Continuity- and Navier-S 	Stokes-Equation by using physical boundary	Conditions	
Skills	The students are able to			
	describe and model incompressible flavo methometic	inally.		
	 describe and model incompressible flows mathemati reduce the governing equations of fluid mechanics b 		ana a a by intogration	
	notice the dependency between theory and technical		ons e.g. by integration	
	use the learned basics for fluid dynamical application			
	use the learned basics for fluid dynamical application	is in fields of process engineering		
Personal Competence				
Social Competence	The students			
	are capable to gather information from subject related	d professional publications and relate that int	formation to the contex	of the lecture and
	able to work together on subject related tasks in sma			
	exercises)	9		(gg g
	are able to work out solutions for exercises by themse	elves, to discuss the solutions orally and to pr	resent the results.	
Autonomy	The students are able to			
	search further literature for each topic and to expand	their knowledge with this literature,		
	work on their exercises by their own and to evaluate a			
	·			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	3 hours			
Assignment for the Following	General Engineering Science (German program): Specialisa	ation Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisa	ation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisa	• • •		
	General Engineering Science (German program, 7 semester		•	
	General Engineering Science (German program, 7 semester			
	General Engineering Science (German program, 7 semester	r): Specialisation Energy and Enviromental E	ngineering: Compulso	ry
	Bioprocess Engineering: Core qualification: Compulsory	Compulsory		
	Energy and Environmental Engineering: Core qualification: (
	General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa		Compulsory	
	General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa		JoinpuisUTy	
	General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester		ulsorv	
		,. openiumounom i roccas Engineening. Comp	a.551 y	
): Specialisation Bioprocess Engineering: Co.	mpulsory	
	General Engineering Science (English program, 7 semester			v
): Specialisation Energy and Enviromental En		у



Course L0091: Fundamentals of Flui	id Mechanics
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Michael Schlüter
Language	DE
Cycle	SoSe
Content	 fluid properties hydrostatic overall balances - theory of streamline overall balances- conservation equations differential balances - Navier Stokes equations irrotational flows - Potenzialströmungen flow around bodies - theory of physical similarity turbulent flows compressible flows
Literature	 Crowe, C. T.: Engineering fluid mechanics. Wiley, New York, 2009. Durst, F.: Strömungsmechanik: Einführung in die Theorie der Strömungen von Fluiden. Springer-Verlag, Berlin, Heidelberg, 2006. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994 Herwig, H.: Strömungsmechanik: Eine Einführung in die Physik und die mathematische Modellierung von Strömungen. Springer Verlag, Berlin, Heidelberg, New York, 2006 Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008 Kuhlmann, H.C.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2009 Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007 Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berlin, Heidelberg, 2008 Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006 van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882. White, F.: Fluid Mechanics, Mcgraw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011

Course L0092: Fluid Mechanics for	Process Engineering
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Michael Schlüter
Language	DE
Cycle	SoSe
Content	In the exercise-lecture the topics from the main lecture are discussed intensively and transferred into application. For that, the students receive example tasks for download. The students solve these problems based on the lecture material either independently or in small groups. The solution is discussed with the students under scientific supervision and parts of the solutions are presented on the chalk board. At the end of each exercise-lecture, the correct solution is presented on the chalk board. Parallel to the exercise-lecture tutorials are held where the student solve exam questions under a set time-frame in small groups and discuss the solutions afterwards.
Literature	 Crowe, C. T.: Engineering fluid mechanics. Wiley, New York, 2009. Durst, F.: Strömungsmechanik: Einführung in die Theorie der Strömungen von Fluiden. Springer-Verlag, Berlin, Heidelberg, 2006. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994. Herwig, H.: Strömungsmechanik: Eine Einführung in die Physik und die mathematische Modellierung von Strömungen. Springer Verlag, Berlin, Heidelberg, New York, 2006. Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008. Kuhlmann, H.C.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2009. Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007. Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berlin, Heidelberg, 2008. Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006. van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882. White, F.: Fluid Mechanics, Mcgraw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011.



Module M0544: Phase Equ	ilibria Thermodynamics			
Courses				
Title		Тур	Hrs/wk	CP
Phase Equilibria Thermodynamics (L0114		Lecture	2	2
Phase Equilibria Thermodynamics (L0140		Recitation Section (small)	1	2
Phase Equilibria Thermodynamics (L0142		Recitation Section (large)	1	2
Module Responsible	Prof. Irina Smirnova	Hookaton coolen (aligo)	•	
Admission Requirements	None			
Recommended Previous	Mathematics, Physical Chemistry, Thermodynamics I and II			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	owing learning results		
Professional Competence				
Knowledge				
	Starting from the very basics of thermodynamics, the	students learn the mathematical tools to descr	ribe thermodynamic e	quilibria.
	They learn how state variables are influenced by the	mixing of compounds and learn concepts to q	uantitatively describe	these properties.
	 Moreover, the students learn how phase equilibria ca 	an be described mathematically and which ph	ienomena may occur i	f different phases (vapor
	liquid, solid) coexist in equilibrium. Furthermore the fo	undamentals of reaction equilibria are taught.		
	 For different phase equilibria, several examples relevant 	vant for different kinds of processes are shown	and the necessary ki	nowledge for plotting and
	interpreting the equilibria are taught.			
Skills	Applying their knowledge, the students are able to i	dentify the correct equation for the determina	ation of the equilibriur	n state and know how to
	simplify these equations meaningfully.			
	The students know models which can be used to de-	stermine the properties of the system in the e	auilibrium etata and t	hey are able to colve the
	resulting mathematical relations.	stermine the properties of the system in the c	quiibilaiii state ana t	ncy are able to solve are
			-f	
	For specific applications, they are able to self-reliant	y ilita flecessary physico-chemical properties	oi compounds as wei	i as illouel parameters il
	literature sources.			
	Beside pure compound properties the students are compound properties.			
	The students know how to visualize phase equilibria			
	Based on their knowledge, the students are able to	to understand fundamental concepts that are	e the basis for many	separation and reaction
	processes in chemical engineering.			
Personal Competence				
Social Competence	The students are able to work in small groups, to solve the co	orresponding problems and to present them of	raly to the tutors and o	ther students
Autonomy	3. 3. 3. 3. 3. 3. 3. 3. 3. 3. 3. 3. 3. 3	and to proceed them of	,	
Autonomy	 The students are able to find necessary information s 	elf-reliantly in literature sources and to judge	their quality.	
	During the semester the students are able to check t	heir learning progress continuously in exercis	ses. Based on this kno	wledge the students car
	adept their learning process.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes; theoretical questions and calculations			
Assignment for the Following	General Engineering Science (German program): Specialisa	ation Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisa	ation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester	r): Specialisation Process Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester	r): Specialisation Bioprocess Engineering: Co	mpulsory	
	Bioprocess Engineering: Core qualification: Compulsory	. 5	•	
	General Engineering Science (English program): Specialisa	tion Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program). Specialisa		leory	
			•	
	General Engineering Science (English program, 7 semester)	j. opecialisation bioprocess Engineering: Cor	iipuisury	
	Process Engineering: Core qualification: Compulsory			



Course L0114: Phase Equilibria The	rmodynamics
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	SoSe
Content	
	1. Introduction: Applications of thermodynamics of mixtures 2. Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity 3. Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule 4. Equations of state: virial equations, van-der-Waals equation, generalized equations of state 5. Mixing properties: ideal and real mixtures, excess properties, partial molar properties 6. Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition 7. Gas-liquid-equilibria: equilibrium condition, Henry-coefficient 8. GE-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC 9. Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems 10. Solid-liquid-equilibria: equilibrium condition, binary systems 11. Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature 12. Osmotic pressure
Literature	 Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997.J.P. O'Connell, J.M. Haile: Thermodynamics. Cambridge University Press, 2005.

Course L0140: Phase Equilibria Thermodynamics		
Тур		
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
	Prof. Irina Smirnova	
Lecturer		
Language	DE	
Cycle	SoSe	
Content	Introduction: Applications of thermodynamics of mixtures	
	Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity	
	3. Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule	
	4. Equations of state: virial equations, van-der-Waals equation, generalized equations of state	
	5. Mixing properties: ideal and real mixtures, excess properties, partial molar properties	
	6. Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition	
	7. Gas-liquid-equilibria: equilibrium condition, Henry-coefficient	
	8. G ^E -Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC	
	Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems	
	10. Solid-liquid-equilibria: equilibrium condition, binary systems	
	11. Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature	
	12. Osmotic pressure	
	The students work on tasks in small groups and present their results in front of all students.	
Literature	 Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997.J.P. O'Connell, J.M. Haile: Thermodynamics. Cambridge University Press, 2005. 	



Course L0142: Phase Equilibria The	rmodynamics
Тур	Recitation Section (large)
Hrs/wk	
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	SoSe
Content	1. Introduction: Applications of thermodynamics of mixtures 2. Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity 3. Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule 4. Equations of state: virial equations, van-der-Waals equation, generalized equations of state 5. Mixing properties: ideal and real mixtures, excess properties, partial molar properties 6. Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition 7. Gas-liquid-equilibria: equilibrium condition, Henry-coefficient 8. GE-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC 9. Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems 10. Solid-liquid-equilibria: equilibrium condition, binary systems 11. Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature 12. Osmotic pressure
Literature	 Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997.J.P. O'Connell, J.M. Haile: Thermodynamics. Cambridge University Press, 2005.



Courses				
Title		Тур	Hrs/wk	СР
Biochemistry (L0351)		Lecture	2	2
Biochemistry (L0728)		Problem-based Learning	1	1
Microbiology (L0881)		Lecture	2	2
Microbiology (L0888)		Problem-based Learning	1	1
Module Responsible	Dr. Paul Bubenheim			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ned the following learning results		
Professional Competence				
Knowledge	At the end of this module the students can:			
	- explain the methods of biological and biochemic	al research to determine the properties of biomolecules		
	- name the basic components of a living organism	ı		
	- explain the principles of metabolism			
	- describe the structure of living cells			
	-			
Skills				
Personal Competence				
Social Competence	The students are able,			
coola. compotence	The statement are usic,			
	- to gather knowledge in groups of about 10 stude	ents		
	- to introduce their own knowledge and to argue the	neir view in discussions in teams		
	- to divide a complex task into subtasks, solve the	se and to present the combined results		
Autonomy	The students are able to present the results of the	ir subtasks in a written report		
Workload in Hours	Independent Study Time 96, Study Time in Lecture	e 84		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program):	Specialisation Bioprocess Engineering: Compulsory		
Curricula		7 semester): Specialisation Bioprocess Engineering: Co	mpulsorv	
	Bioprocess Engineering: Core qualification: Comp		F =:==:)	
		Specialisation Bioprocess Engineering: Compulsory		
		7 semester): Specialisation Bioprocess Engineering: Co	mpulsory	
	Technomathematics: Specialisation III. Engineerin			



Course L0351: Biochemistry	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Paul Bubenheim
Language	DE
Cycle	SoSe
Content	
	The molecular logic of Life
	2. Biomolecules:
	1. Amino acids, peptides, proteins
	2. Carbohydrates
	3. Lipids
	3. Protein functions, Enzymes:
	1. Michaelis-Menten kinetics
	2. Enzyme regulation
	S. Enzyme nomenclature Cofactors and cosubstrates, vitamines
	Colaciors and cosubstrates, vitamines Metabolism:
	Netabolism: Basic principles
	2. Photosynthesis
	3. Glycolysis
	4. Citric acid cycle
	5. Respiration
	6. Anaerobic respirations
	7. Fatty acid metabolism
	8. Amino acid metabolism
Literature	Biochemie, H. Robert Horton, Laurence A. Moran, K. Gray Scrimeour, Marc D. Perry, J. David Rawn, Pearson Studium, München
	Prinzipien der Biochemie, A. L. Lehninger, de Gruyter Verlag Berlin

Course L0728: Biochemistry			
Тур	Problem-based Learning		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Dr. Paul Bubenheim		
Language	DE		
Cycle	SoSe		
Content	1. The molecular logic of Life 2. Biomolecules: 1. Amino acids, peptides, proteins 2. Carbohydrates 3. Lipids 3. Protein functions, Enzymes: 1. Michaelis-Menten kinetics 2. Enzyme regulation 3. Enzyme nomenclature 4. Cofactors and cosubstrates, vitamines 5. Metabolism: 1. Basic principles 2. Photosynthesis 3. Glycolysis 4. Citric acid cycle		
	5. Respiration 6. Anaerobic respirations 7. Fatty acid metabolism 8. Amino acid metabolism		
Literature	Biochemie, H. Robert Horton, Laurence A. Moran, K. Gray Scrimeour, Marc D. Perry, J. David Rawn, Pearson Studium, München Prinzipien der Biochemie, A. L. Lehninger, de Gruyter Verlag Berlin		



Course L0881: Microbiology	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Christian Schäfers
Language	DE
Cycle	SoSe
Content	1. The procaryotic cell • evolution • taxonomy and specific properties of Archaea, Bacteria, and viruses
	structure and properties of the cell growth
Litavatura	2. Metabolism • fermentation and anaerobic respiration • methanogenesis and the anaerobic food chain • degradation of polymers • chemolithotrophy 3. Microorganisms in relation to the environment • chemotaxis and motility • Elemental cycle of carbon, nitrogen and sulfur • biofilms • symbiotic relationships • extremophiles • biotechnology
Literature	 Allgemeine Mikrobiologie, 8. Aufl., 2007, Fuchs, G. (Hrsg.), Thieme Verlag (54,95 €) Mikrobiologie, 13 Aufl., 2013, Madigan, M., Martinko, J. M., Stahl, D. A., Clark, D. P. (Hrsg.), ehemals "Brock", Pearson Verlag (89,95 €) Taschenlehrbuch Biologie Mikrobiologie, 2008, Munk, K. (Hrsg.), Thieme Verlag Grundlagen der Mikrobiologie, 4. Aufl., 2010, Cypionka, H., Springer Verlag (29,95 €), http://www.grundlagen-der-mikrobiologie.icbm.de/



Course L0888: Microbiology	
Тур	Problem-based Learning
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Christian Schäfers
Language	DE
Cycle	SoSe
Content	1. The procaryotic cell
	evolution
	taxonomy and specific properties of Archaea, Bacteria, and viruses
	structure and properties of the cell
	• growth
	2. Metabolism
	fermentation and anaerobic respiration
	methanogenesis and the anaerobic food chain
	degradation of polymers
	chemolithotrophy
	3. Microorganisms in relation to the environment
	chemotaxis and motility
	Elemental cycle of carbon, nitrogen and sulfur
	• biofilms
	symbiotic relationships
	• extremophiles
	biotechnology
Literature	
	• Allgemeine Mikrobiologie, 8. Aufl., 2007, Fuchs, G. (Hrsg.), Thieme Verlag (54,95 €)
	• Mikrobiologie, 13 Aufl., 2013, Madigan, M., Martinko, J. M., Stahl, D. A., Clark, D. P. (Hrsg.), ehemals "Brock", Pearson Verlag (89,95 €)
	Taschenlehrbuch Biologie Mikrobiologie, 2008, Munk, K. (Hrsg.), Thieme Verlag
	• Grundlagen der Mikrobiologie, 4. Aufl., 2010, Cypionka, H., Springer Verlag (29,95 €), http://www.grundlagen-der-mikrobiologie.icbm.de/



ourses			
itle	Typ Hrs/wk CP		
gnals and Systems (L0432)	Lecture 3 4		
gnals and Systems (L0433)	Recitation Section (large) 1 2		
Module Responsible	Prof. Gerhard Bauch		
Admission Requirements	None		
Recommended Previous	Mathematics 1-3		
Knowledge	The modul is an introduction to the theory of signals and systems. Good knowledge in maths as covered by the moduls Mathematik 1-3 is expect		
	Further experience with spectral transformations (Fourier series, Fourier transform, Laplace transform) is useful but not required.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	The students are able to classify and describe signals and linear time-invariant (LTI) systems using methods of signal and system theory. They are a		
	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse deterministic signal		
	and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image domain which		
Chilla	caused by the transition of a continuous-time signal to a discrete-time signal. The students are able to describe and applying data ministry signal, and linear time invariant systems using methods of signal, and system theory. The		
Skills	The students are able to describe and analyse deterministic signals and linear time-invariant systems using methods of signal and system theory. The can analyse and design basic systems regarding important properties such as magnitude and phase response, stability, linearity etc They can ass		
	the impact of LTI systems on the signal properties in time and frequency domain.		
Personal Competence	and impact of E 1 systems of the signal proportion in time and requestly domain.		
Social Competence	The students can jointly solve specific problems.		
Autonomy	The students can jointly solve specific problems. The students are able to acquire relevant information from appropriate literature sources. They can control their level of knowledge during the lect		
Adionomy	period by solving tutorial problems, software tools, clicker system.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Examination	Written exam		
Examination duration and scale	90 min		
Assignment for the Following	General Engineering Science (German program): Specialisation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Electrical Engineering. Compulsory General Engineering Science (German program): Specialisation Computer Science: Compulsory		
Ourricula	General Engineering Science (German program): Specialisation Process Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory		
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulso		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science		
	Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineeri		
	Compulsory		
	Computer Science: Core qualification: Compulsory		
	Electrical Engineering: Core qualification: Compulsory General Engineering: Core (English program): Specialisation Civils and Environmental Engangering: Compulsory		
	General Engineering Science (English program): Specialisation Civil- and Enviromental Engeneering: Compulsory General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Computer Science: Compulsory		
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulso		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science		
	Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering		
	Compulsory		
	Computational Science and Engineering: Core qualification: Compulsory Mechatronics: Core qualification: Compulsory		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	S		
Тур	Lecture		
Hrs/wk	3		
СР	4		
Workload in Hours	ndependent Study Time 78, Study Time in Lecture 42		
Lecturer	rof. Gerhard Bauch		
Language	DE/EN CoCo		
Cycle Content	SoSe Basic classification and description of continuous-time and discrete-time signals and systems		
	Concvolution		
	Power and energy of signals		
	Correlation functions of deterministic signals		
	Linear time-invariant (LTI) systems		
	Signal transformations:		
	Fourier-Series		
	Fourier Transform		
	Laplace Transform		
	Discrete-time Fourier Transform		
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)		
	Z-Transform		
	Analysis and design of LTI systems in time and frequency domain		
	Basic filter types		
	Sampling, sampling theorem		
	Fundamentals of recursive and non-recursive discrete-time filters		
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004		
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.		
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997		
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002		
	S. Haykin, B. van Veen: Signals and systems. Wiley.		
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.		
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.		

Course L0433: Signals and Systems		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Gerhard Bauch	
Language	DE/EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0938: Bioprocess	s Engineering - Fundamentals			
Courses				
Title		Тур	Hrs/wk	CP
Bioprocess Engineering - Fundamentals (L0841)		Lecture	2	3
Bioprocess Engineering- Fundamentals (L0842)		Recitation Section (large)	2	1
Bioprocess Engineering - Fundamental Pr		Laboratory Course	2	2
Module Responsible	Prof. Andreas Liese			
Admission Requirements	none			
Recommended Previous	none, module "organic chemistry", module "fundamentals for proc	ess engineering"		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	Students are able to describe the basic concepts of bioprocess engineering. They are able to classify different types of kinetics for enzymes a microorganisms, as well as to differentiate different types of inhibition. The parameters of stoichiometry and rheology can be named and mass transp processes in bioreactors can be explained. The students are capable to explain fundamental bioprocess management, sterilization technology a downstream processing in detail.			
Skills	After successful completion of this module, students should be able to describe different kinetic approaches for growth and substrate-uptake and to calculate the corresponding parameters predict qualitatively the influence of energy generation, regeneration of redox equivalents and growth inhibition on the fermentation process analyze bioprocesses on basis of stoichiometry and to set up / solve metabolic flux equations distinguish between scale-up criteria for different bioreactors and bioprocesses (anaerobic, aerobic as well as microaerobic) to compare the well as to apply them to current biotechnical problem propose solutions to complicated biotechnological problems and to deduce the corresponding models to explore new knowledge resources and to apply the newly gained contents identify scientific problems with concrete industrial use and to formulate solutions. to document and discuss their procedures as well as results in a scientific manner			
Personal Competence Social Competence Autonomy	After completion of this module participants should be able to debate technical questions in small teams to enhance the ability to take position to the own opinions and increase their capacity for teamwork in engineering and scientific environments.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
		Process Engineering Committee		
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation I			
Gurricula	General Engineering Science (German program): Specialisation I General Engineering Science (German program, 7 semester): Sp.		ulsory	
	General Engineering Science (German program, 7 semester): Spi	0 0 1	,	
	Bioprocess Engineering: Core qualification: Compulsory	ecialisation bioprocess Engineering. Con	привогу	
	General Engineering Science (English program): Specialisation E	tionrocoss Engineering: Compulsory		
	General Engineering Science (English program): Specialisation F		loon.	
	General Engineering Science (English program, 7 semester): Spe		•	
	General Engineering Science (English program, 7 semester): Spe		iipuisory	
	Biomedical Engineering: Specialisation Artificial Organs and Reg			
	Biomedical Engineering: Specialisation Implants and Endoprosth			
	Biomedical Engineering: Specialisation Medical Technology and	, , ,		
	Biomedical Engineering: Specialisation Management and Busine			
	Technomathematics: Specialisation III. Engineering Science: Elec	sive Compulsory		
	Process Engineering: Core qualification: Compulsory			



Course L0841: Bioprocess Engineering - Fundamentals				
Тур	Lecture			
Hrs/wk	2			
CP	3			
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28			
Lecturer	Prof. Andreas Liese, Prof. An-Ping Zeng			
Language	DE			
Cycle	SoSe			
Content	 Introduction: state-of-the-art and development trends in the biotechnology, introduction to the lecture Enzyme kinetics: Michaelis-Menten, differnt types of enzyme inhibition, linearization, conversion, yield, selectivity (Prof. Liese) Stoichiometry: coefficient of respiration, electron balance, degree of reduction, coefficient of yield, theoretical oxygen demand (Prof. Liese) Microbial growth kinetic: batch- and chemostat culture (Prof. Zeng) Kinetic of subtrate consumption and product formation (Prof. Zeng) Rheology: non-newtonian fluids, viscosity, agitators, energy input (Prof. Liese) Transport process in a bioreactor (Prof. Zeng) Technology of sterilization (Prof. Zeng) Fundamentals of bioprocess management: bioreactors and calculation of batch, fed-batch and continuouse bioprocesses (Prof. Zeng/Prof. Liese) Downstream technology in biotechnology: cell breakdown, zentrifugation, filtration, aqueous two phase systems (Prof. Liese) 			
Literature	K. Buchholz, V. Kasche, U. Bornscheuer: Biocatalysts and Enzyme Technology, 2. Aufl. Wiley-VCH, 2012 H. Chmiel: Bioprozeßtechnik, Elsevier, 2006 R.H. Balz et al.: Manual of Industrial Microbiology and Biotechnology, 3. edition, ASM Press, 2010 H.W. Blanch, D. Clark: Biochemical Engineering, Taylor & Francis, 1997 P. M. Doran: Bioprocess Engineering Principles, 2. edition, Academic Press, 2013			

Course L0842: Bioprocess Engineering- Fundamentals		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Prof. Andreas Liese, Prof. An-Ping Zeng	
Language	DE	
Cycle	SoSe	
Content	1. Introduction (Prof. Liese, Prof. Zeng)	
	2. Enzymatic kinetics (Prof. Liese)	
	3. Stoichiometry I + II (Prof. Liese)	
	4. Microbial Kinetics I+II (Prof. Zeng)	
	5. Rheology (Prof. Liese)	
	6. Mass transfer in bioprocess (Prof. Zeng)	
	7. Continuous culture (Chemostat) (Prof. Zeng)	
	8. Sterilisation (Prof. Zeng)	
	9. Downstream processing (Prof. Liese)	
	10. Repetition (Reserve) (Prof. Liese, Prof. Zeng)	
Literature	siehe Vorlesung	

Course L0843: Bioprocess Engineering - Fundamental Practical Course		
Тур	Laboratory Course	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Andreas Liese, Prof. An-Ping Zeng	
Language	DE	
Cycle	SoSe	
Content	In this course fermentation and downstream technologies on the example of the production of an enzyme by means of a recombinant microorganism is learned. Detailed characterization and simulation of enzyme kinetics as well as application of the enzyme in a bioreactor is carried out. The students document their experiments and results in a protocol.	
Literature	Skript	



Module M0538: Heat and N	lass Transfer			
Courses				
Title		Тур	Hrs/wk	СР
Heat and Mass Transfer (L0101)		Lecture	2	2
Heat and Mass Transfer (L0102)		Recitation Section (small)	1	2
Heat and Mass Transfer (L1868)		Recitation Section (large)	1	2
Module Responsible	Prof. Irina Smirnova			
Admission Requirements				
Recommended Previous				
Knowledge				
Educational Objectives	After taking part augeopafully, at idente have received the fi	Maying Logging regults		
Professional Competence		bildwing learning results		
Knowledge				
	 The students are capable of explaining qualitativ chemical reactors). They are capable of distinguish and characterize or radiation. The students have the ability to explain the physical using suitable mass transfer theories. They are able to depict the analogy between heat- 	different kinds of heat transfer mechanisms nam	ely heat conduction, be mass transfer quali	neat transfer and thermal
Skills	The students are able to set reasonable system be corresponding energy and mass flow, respectively. They are capable to solve specific heat transfer percorresponding heat flows. Using dimensionless quantities, the students can eee They are able to distinguish between diffusion, conducted and design of apparatus (e.g. extraction column, reee In this context, the students are capable to choo considering their advantages and disadvantages, In addition, they can calculate both, steady-state are The students are capable to connect their known thermodynamics, fluid mechanics and chemical process.	roblems (e.g. heated chemical reactors, tempe xecute scaling up of technical processes or app invective mass transition and mass transfer. The ctification column). Dose and design fundamental types of heat an espectively. Ind non-steady-state processes in procedural application obtained in this course with knowlegor.	aratus. ey can use this know d mass exchanger f paratus. le of other courses (ilds) and to calculate the eledge for the description or a specific application
Personal Competence Social Competence		fic challenges in teams and to present the resu	lts orally in a reasona	ble manner to tutors and
Autonomy	The students are able to find and evaluate necessa They are able to prove their level of knowledge assignments) and on this basis they can control the	e during the course with accompanying proce	edure continuously (d	elicker-system, exam-like
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes; theoretical questions and calculations			
Assignment for the Following				
Curricula				
	General Engineering Science (German program): Speciali General Engineering Science (German program, 7 semes	•		
			•	
ı	General Engineering Science (German program, 7 semes		ripuisory	
	General Engineering Science (German program, 7 semes General Engineering Science (German program, 7 semes			y
				у
	General Engineering Science (German program, 7 semes	ter): Specialisation Energy and Enviromental En		у
	General Engineering Science (German program, 7 semes Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Specialis	ter): Specialisation Energy and Enviromental En n: Compulsory sation Bioprocess Engineering: Compulsory	gineering: Compulso	у
	General Engineering Science (German program, 7 semes Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualificatior General Engineering Science (English program): Specialis General Engineering Science (English program): Specialis	ter): Specialisation Energy and Enviromental En n: Compulsory sation Bioprocess Engineering: Compulsory sation Energy and Enviromental Engineering: Co	gineering: Compulso	у
	General Engineering Science (German program, 7 semest Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Specialist General Engineering Science (English program): Specialist General Engineering Science (English program): Specialist	ter): Specialisation Energy and Enviromental En :: Compulsory sation Bioprocess Engineering: Compulsory sation Energy and Enviromental Engineering: Co sation Process Engineering: Compulsory	gineering: Compulsor	у
	General Engineering Science (German program, 7 semest Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Specialis General Engineering Science (English program): Specialis General Engineering Science (English program): Specialis General Engineering Science (English program, 7 semest	ter): Specialisation Energy and Enviromental En a: Compulsory sation Bioprocess Engineering: Compulsory sation Energy and Enviromental Engineering: Cos sation Process Engineering: Compulsory er): Specialisation Process Engineering: Compu	gineering: Compulsor ompulsory	у
	General Engineering Science (German program, 7 semest Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Specialis General Engineering Science (English program): Specialis General Engineering Science (English program): Specialis General Engineering Science (English program, 7 semest General Engineering Science (English program, 7 semest	ter): Specialisation Energy and Enviromental En a: Compulsory sation Bioprocess Engineering: Compulsory sation Energy and Enviromental Engineering: Cosation Process Engineering: Compulsory er): Specialisation Process Engineering: Compu	gineering: Compulsor pmpulsory lsory npulsory	
	General Engineering Science (German program, 7 semest Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Specialis General Engineering Science (English program): Specialis General Engineering Science (English program): Specialis General Engineering Science (English program, 7 semest	ter): Specialisation Energy and Enviromental En a: Compulsory sation Bioprocess Engineering: Compulsory sation Energy and Enviromental Engineering: Co sation Process Engineering: Compulsory er): Specialisation Process Engineering: Compu er): Specialisation Bioprocess Engineering: Con er): Specialisation Energy and Enviromental Eng	gineering: Compulsor pmpulsory lsory npulsory	
	General Engineering Science (German program, 7 semest Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Specialis General Engineering Science (English program): Specialis General Engineering Science (English program): Specialis General Engineering Science (English program, 7 semest	ter): Specialisation Energy and Environmental En a: Compulsory sation Bioprocess Engineering: Compulsory sation Energy and Environmental Engineering: Co sation Process Engineering: Compulsory er): Specialisation Process Engineering: Compu er): Specialisation Bioprocess Engineering: Compu er): Specialisation Energy and Environmental Engue: Elective Compulsory	gineering: Compulsor pmpulsory lsory npulsory	



Course L0101: Heat and Mass Transfer		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	WiSe	
Content	1. Heat transfer Introduction, one-dimensional heat conduction Convective heat transfer Multidimensional heat conduction Non-steady heat conduction Thermal radiation Mass transfer one-way diffusion, equimolar countercurrent diffusion boundary layer theory, non-steady mass transfer Heat and mass transfer single particle/ fixed bed Mass transfer and chemical reactions	
Literature	H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer VDI-Wärmeatlas	

Course L0102: Heat and Mass Transfer		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

ourse L1868: Heat and Mass Transfer		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0546: Thermal Se	eparation Processes			
Courses				
Title		Тур	Hrs/wk	СР
Thermal Separation Processes (L0118)		Lecture	2	2
Thermal Separation Processes (L0119)		Recitation Section (small)	2	2
Thermal Separation Processes (L0141)		Recitation Section (large)	1	1
Separation Processes (L1159)		Laboratory Course	1	1
Module Responsible	Prof. Irina Smirnova			
Admission Requirements	None			
Recommended Previous	Recommended requirements: Thermodynamics III			
Knowledge	,			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge				
	 The students can distinguish and describe different types of separation processes such as distillation, extraction, and adsorption 			
	 The students develop an understanding for the course of concentration during a separation process, the estimation of the energy demand 			
	process, the possibilities of energy saving, and the selection			
	They have good knowledge of designing methods for separately a separate to the separate t	aration processes and devices		
Skills	 Using the gained knowledge the students can select a rea 	sonable system boundary for a given sep	aration process and	can close the associated
	energy and material balances			
	The students can use different graphical methods for the d	esigning of a senaration process and defi	ne the amount of the	oretical stages required
	They can select and design a basic type of thermal separations.			
		aration process for a given case based to	on the advantages a	nd disadvantages of the
	process	ded as a factor of the second as forms	(4)	dieletera
	The students are capable to obtain independently the nee The students are capable to obtain independently the nee		ources (diagrams ar	id tables)
	They can calculate continuous and discontinuous process			
	The students are able to prove their theoretical knowledge			
	The students are able to discuss the theoretical backgrour	id and the content of the experimental woi	k with the teachers in	n colloquium.
	The students are capable of linking their gained knowledge with	the content of other lectures and use it to	gether for the solution	on of technical problems.
	Other lectures such as thermodynamics, fluid mechanics and cher		9	
	,, ,, ,, ,			
B				
Personal Competence				
Social Competence	The students can work technical assignments in small grounds.	ups and present the combined results in the	ne tutorial	
	g			
	The students are able to carry out practical lab work in sn	nall groups and organize a functional divi	sion of labor betwee	n them. They are able to
	discuss their results and to document them scientifically in		Sion or labor betwee	ir triem. They are able to
	discuss their results and to document them scientifically in	а героп.		
Autonomy				
	The students are capable to obtain the needed information from suitable sources by themselves and assess their quality			
	The students can proof the state of their knowledge with ex	cam resembling assignments and in this w	ay control their learn	ing process
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes; theoretical questions and calculations			
	,	December 1		
Assignment for the Following	General Engineering Science (German program): Specialisation I			
Curricula	General Engineering Science (German program): Specialisation I			
	General Engineering Science (German program): Specialisation I			
	General Engineering Science (German program, 7 semester): Spi		•	
	General Engineering Science (German program, 7 semester): Spi	ecialisation Bioprocess Engineering: Com	pulsory	
	General Engineering Science (German program, 7 semester): Spe	ecialisation Energy and Enviromental Eng	ineering: Compulsor	у
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Comp	oulsory		
	General Engineering Science (English program): Specialisation E			
	General Engineering Science (English program): Specialisation E		mpulsory	
	General Engineering Science (English program): Specialisation F		. ,	
	General Engineering Science (English program, 7 semester): Specialisation		sorv	
	General Engineering Science (English program, 7 semester): Spe		•	
	General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Spe	, , , , , , , , , , , , , , , , , , , ,	-	,
		oranoanon Energy and Environmental Engl		,
	Process Engineering: Core qualification: Compulsory			



Course L0118: Thermal Separation Processes			
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Irina Smirnova		
Language	DE		
Cycle	WiSe		
Content	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes		
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry's Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann's Enzyklopädie der Technischen Chemie 		



Course L0119: Thermal Separation	Processes
Тур	Recitation Section (small)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes The students work on tasks in small groups and present their results in front of all students.
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann's Enzyklopädie der Technischen Chemie



Course L0141: Thermal Separation	Processes
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	 Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann"s Enzyklopädie der Technischen Chemie



Course L1159: Separation Processe) \$
Тур	Laboratory Course
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Course work	Compulsory attendence of the colloquia of all experiments and compulsory report.
Lecturer	Prof. Irina Smirnova
Language	DE/EN
Cycle	SoSe
Content	The students work on eight different experiments in this practical course. For every one of the eight experiments, a colloquium takes place in which the
	students explain and discuss the theoretical background and its translation into practice with staff and fellow students.
	The students work small groups with a high degree of division of labor. For every experiment, the students write a report. They receive instructions in
	terms of scientific writing as well as feedback on their own reports and level of scientific writing so they can increase their capabilities in this area.
	Topics of the practical course:
	Introduction in the thermal process engineering and to the main features of separation processes
	Simple equilibrium processes, several steps processes
	Distillation of binary mixtures, enthalpy-concentration diagrams
	Extractive and azeotrope distillation, water vapor distillation, stepwise distillation
	Extraction: separation ternary systems, ternary diagram
	Multiphase separation including complex mixtures
	Designing of separation devices without discrete stages
	• Drying
	Chromatographic separation processes Membrane separation
	Membrane separation Energy demand of separation processes
	Advance overview of separation processes
	Selection of separation processes
Literature	
	G. Brunner: Skriptum Thermische Verfahrenstechnik
	J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Out of The Control of The Contro
	Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Gooden F. H. Harley Goognation Property Priorities William No. 2014 (1992) Application of the Market Control of the Market
	 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980
	Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997
	Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff,
	Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3.
	R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006.
	Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann"s
	Enzyklopädie der Technischen Chemie



Module M0892: Chemical R	eaction Engineering			
Courses				
Title		Тур	Hrs/wk	CP
Chemical Reaction Engineering (Fundame	ntals) (L0204)	Lecture	2	2
Chemical Reaction Engineering (Fundame		Recitation Section (large)	2	2
Experimental Course Chemical Engineerin		Laboratory Course	2	2
Module Responsible	Prof. Raimund Horn			
Admission Requirements	None			
Recommended Previous	Contents of the previous modules mathematics I-III, phy	rsical chemistry, technical thermodynamics I+II as w	rell as computational r	nethods for engineers.
Knowledge				
Educational Objectives	After taking part successfully, students have reached th	e following learning results		
Professional Competence				
Knowledge	The students are able to explain basic concepts of che	mical reaction engineering. They are able to point	out differences betwe	en thermodynamical and
	kinetical processes. The students have a strong ability	to outline parts of isothermal and non-isothermal ide	eal reactors and to des	scribe their properties.
Skills	After successful completion of the module, students are	able to:		
	- apply different computational methods to dimension isothermal and non-isothermal ideal reactors,			
	- determine and compute stable operation points for these reactors ,			
	- conduct experiments on a lab-scale pilot plants and d	ocument these according to scientific guidelines.		
Personal Competence				
Social Competence	After successful completition of the lab-course the stu	dents have a strong ability to organize themselfe	s in small groups to	solve issues in chemical
	reaction engineering. The students can discuss their su	bject related knowledge among each other and wit	th their teachers.	
Autonomy	The students are able to obtain further information an	d assess their relevance autonomously. Students	can apply their know	dege discretely to plan
	prepare and conduct experiments.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Spec	sialisation Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Spec			
	General Engineering Science (German program, 7 sen	nester): Specialisation Process Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 sem	, ,	•	
	Bioprocess Engineering: Core qualification: Compulsor	y	•	
	General Engineering Science (English program): Spec			
	General Engineering Science (English program): Spec	alisation Process Engineering: Compulsory		
	General Engineering Science (English program, 7 sem	ester): Specialisation Process Engineering: Compu	lsory	
	General Engineering Science (English program, 7 sem	ester): Specialisation Bioprocess Engineering: Con	npulsory	
	Process Engineering: Core qualification: Compulsory			

Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Raimund Horn
Language	DE
Cycle	WiSe
	Fundamentals of chemical reaction engineering, definitions, calculation of species concentrations (reactor, reaction mixture, reactants, products, ine and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentration, mass concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, conversion selectivity, yield, concentration calculations in stationary and flowing multicomponent-mixtures)
	Stoichiometry and stoichiometric calculations (simple reactions, complex reactions, key reactions, key species, matrix of stoichiometric coefficients, line dependent and independent reactions, element-species-matrix, row reduced form of a matrix, rank of a matrix, Gauss Jordan elimination, relative between stoichiometry and kinetics, calculating the extent of reaction from mole number changes in complex reactions)
	Thermodynamics (What is thermodynamics?, importance of thermodynamics in chemical reaction engineering, zeroth law of thermodynamic temperature scales, temperature measurements in praxis, first law of thermodynamics, internal energy, enthalpy, calorimeter, heat of reaction, standard heat of formation, Hess law, heat capacity, Kirchhoff law, standard heat of reaction, pressure dependence of the heat of reaction, second law thermodynamics, reversible and irreversible processes, entropy, Clausius inequality, free energy, Gibbs Energy, chemical potential, chemical equilibrium, activity, van't Hoff law, calculation of chemical equilibrium, principle of Le Chatelier and Braun, equilibrium calculations in multiple reactions systems, Lagrange Multipliers)
	Chemical kinetics (reversible and irreversible reactions, homogeneous and heterogeneous reactions, elementary step, reaction mechanis microkinetics, formal kinetics, reaction rate, rate of change of species mole number, Arrhenius-equation, activation energy and p exponential factor for komplex reactions, reactions of 0., 1. and 2. order, analytical integration of rate laws, Damköhler-number, differential and integ method of kinetic analysis, laboratory reactors for kinetic measurements, half life, kinetics of complex reactions, parallel reactions, reversible reaction sequence of reactions, irreversible reaction with pre-equilibrium, reduction of reaction mechanisms, quasi-stationarity principle of Bodenstein, rallimiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of complikinetics)



single phase - biphasic- and multiphase reactors, batch-reactor, semi-batch reactor, CSTR, Plug Flow reactor, fixed bed reactor, adiabatic staged reactors, rotating furnaces, fluidized bed reactors, gas-liquid-reactors, multi-phase reactors)

Isothermal ideal reactors (mole-balance of a chemical reactor, mole balance of a batch reactor, integration of the batch reactor mole balance for various kinetics, partial fraction decomposition, mole balance of the semi-batch reactor, mole balance of the plug flow reactor, analogy batch reactor - plug flow reactor, design of plug flow reactors for reactions with volume change and complex reactions, mole balance of a fixed bed reactor, design of a membrane reactor, mole balance of a continuously stirred tank reactor, comparison of CSTR and PFR with respect to conversion and selectivity, mole-balance of a cascade of tank reactors, numerical-interative calculation of a cascade of tank reactors, Newton-Raphson method, graphical analysis of a cascade of tank reactors).

non-isothermal ideal reactors (energy balance of a reactor, adiabatic reactor, adiabatic temperature rise, staged reactor for adiabatic exothermic reactions limited by chemical equilibrium, design of an adiabatic plug flow reactor, Levenspiel-plots, heat transfer through a reactor wall, heat transfer by convection, heat conduction, heat transfer through a cylindrical wall, design of a plug flow reactor in parallel and counter flow, heat balance of the cooling fluid, CSTR with heat exchange, multiple stationary states, ignition-extinction behavior, stability of a CSTR, complex reactions in non-isothermal reactors, optimum temperature profile of a reactor)

Literature

lecture notes Raimund Horn

skript Frerich Keil

Books:

- M. Baerns, A. Behr, A. Brehm, J. Gmehling, H. Hofmann, U. Onken, A. Renken, Technische Chemie, Wiley-VCH
- G. Emig, E. Klemm, Technische Chemie, Springer
- A. Behr, D. W. Agar, J. Jörissen, Einführung in die Technische Chemie
- E. Müller-Erlwein, Chemische Reaktionstechnik 2012, 2. Auflage, Teubner Verlag
- J. Hagen, Chemiereaktoren: Auslegung und Simulation, 2004, Wiley-VCH
- H. S. Fogler, Elements of Chemical Reaction Engineering, Prentice Hall B
- $\hbox{H.\,S.\,Fogler,\,Essentials\,of\,Chemical\,\,Reaction\,\,Engineering,\,Prentice\,\,Hall}$
- O. Levenspiel, Chemical Reaction Engineering, John Wiley & Sons, 1998
- L. D. Schmidt, The Engineering of Chemical Reactions, Oxford Univ. Press, 2009
- J. B. Butt, Reaction Kinetics and Reactor Design, 2000, Marcel Dekker
- R. Aris, Elementary Chemical Reactor Analysis, Dover Pubn. Inc., 2000
- $\hbox{M.\,E.\,Davis,\,R.\,J.\,Davis,\,Fundamentals\,of\,Chemical\,\,Reaction\,\,Engineering,\,McGraw\,\,Hill}$
- $\hbox{G.\,F.\,Froment,\,K.\,B.\,Bischoff,\,J.\,De\,Wilde,\,Chemical\,\,Reactor\,\,Analysis\,\,and\,\,Design,\,John\,\,Wiley\,\,\&\,\,Sons,\,2010}$
- A. Jess, P. Wasserscheid, Chemical Technology An Integrated Textbook, WILEY-VCH



	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Raimund Horn, Dr. Oliver Korup
Language	DE WiSe
Cycle	Fundamentals of chemical reaction engineering, definitions, calculation of species concentrations (reactor, reaction mixture, reactants, products, in
	and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentration, m concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, converselectivity, yield, concentration calculations in stationary and flowing multicomponent-mixtures)
	Stoichiometry and stoichiometric calculations (simple reactions, complex reactions, key reactions, key species, matrix of stoichiometric coefficients, li dependent and independent reactions, element-species-matrix, row reduced form of a matrix, rank of a matrix, Gauss Jordan elimination, relibetween stoichiometry and kinetics, calculating the extent of reaction from mole number changes in complex reactions)
	Thermodynamics (What is thermodynamics?, importance of thermodynamics in chemical reaction engineering, zeroth law of thermodynamics temperature scales, temperature measurements in praxis, first law of thermodynamics, internal energy, enthalpy, calorimeter, heat of reaction, stan heat of formation, Hess law, heat capacity, Kirchhoff law, standard heat of reaction, pressure dependence of the heat of reaction, second la thermodynamics, reversible and irreversible processes, entropy, Clausius inequality, free energy, Gibbs Energy, chemical potential, cher equilibrium, activity, van't Hoff law, calculation of chemical equilibrium, principle of Le Chatelier and Braun, equilibrium calculations in multiple reactions, Lagrange Multipliers)
	Chemical kinetics (reversible and irreversible reactions, homogeneous and heterogeneous reactions, elementary step, reaction mechan microkinetics, macrokinetics, formal kinetics, reaction rate, rate of change of species mole number, Arrhenius-equation, activation energy and exponential factor for komplex reactions, reactions of 0., 1. and 2. order, analytical integration of rate laws, Damköhler-number, differential and interest method of kinetic analysis, laboratory reactors for kinetic measurements, half life, kinetics of complex reactions, parallel reactions, reversible react sequence of reactions, irreversible reaction with pre-equilibrium, reduction of reaction mechanisms, quasi-stationarity principle of Bodenstein, limiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of comkinetics)
	Types of chemical Reaktors (chemical reactors in industry and laboratory, ideal vs. real reaktors, discontinuous, half continuous and continuous reacting phase - biphasic- and multiphase reactors, batch-reactor, semi-batch reactor, CSTR, Plug Flow reactor, fixed bed reactor, adiabatic started reactors, rotating furnaces, fluidized bed reactors, gas-liquid-reactors, multi-phase reactors)
	Isothermal ideal reactors (mole-balance of a chemical reactor, mole balance of a batch reactor, integration of the batch reactor mole balance for val kinetics, partial fraction decomposition, mole balance of the semi-batch reactor, mole balance of the plug flow reactor, analogy batch reactor - plug reactor, design of plug flow reactors for reactions with volume change and complex reactions, mole balance of a fixed bed reactor, design membrane reactor, mole balance of a continuously stirred tank reactor, comparison of CSTR and PFR with respect to conversion and selectivity, in balance of a cascade of tank reactors, numerical-interative calculation of a cascade of tank reactors, Newton-Raphson method, graphical analysis cascade of tank reactors)
	non-isothermal ideal reactors (energy balance of a reactor, adiabatic reactor, adiabatic temperature rise, staged reactor for adiabatic exother reactions limited by chemical equilibrium, design of an adiabatic plug flow reactor, Levenspiel-plots, heat transfer through a reactor wall, heat transfer convection, heat conduction, heat transfer through a cylindrical wall, design of a plug flow reactor in parallel and counter flow, heat balance of cooling fluid, CSTR with heat exchange, multiple stationary states, ignition-extinction behavior, stability of a CSTR, complex reactions in non-isother reactors, optimum temperature profile of a reactor)
Literature	lecture notes Raimund Horn
	skript Frerich Keil
	Books:
	M. Baerns, A. Behr, A. Brehm, J. Gmehling, H. Hofmann, U. Onken, A. Renken, Technische Chemie, Wiley-VCH
	G. Emig, E. Klemm, Technische Chemie, Springer
	A. Behr, D. W. Agar, J. Jörissen, Einführung in die Technische Chemie
	E. Müller-Erlwein, Chemische Reaktionstechnik 2012, 2. Auflage, Teubner Verlag
	J. Hagen, Chemiereaktoren: Auslegung und Simulation, 2004, Wiley-VCH
	H. S. Fogler, Elements of Chemical Reaction Engineering, Prentice Hall B
	H. S. Fogler, Essentials of Chemical Reaction Engineering, Prentice Hall
	O. Levenspiel, Chemical Reaction Engineering, John Wiley & Sons, 1998
	L. D. Schmidt, The Engineering of Chemical Reactions, Oxford Univ. Press, 2009
	J. B. Butt, Reaction Kinetics and Reactor Design, 2000, Marcel Dekker
	R. Aris, Elementary Chemical Reactor Analysis, Dover Pubn. Inc., 2000
	M. E. Davis, R. J. Davis, Fundamentals of Chemical Reaction Engineering, McGraw Hill
	G. F. Froment, K. B. Bischoff, J. De Wilde, Chemical Reactor Analysis and Design, John Wiley & Sons, 2010



Course L0221: Experimental Course	e Chemical Engineering (Fundamentals)
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Raimund Horn, Dr. Achim Bartsch
Language	DE/EN
Cycle	SoSe
Content	Performing and evaluation of experiments concerning chemical reaction engineering with emphasis on ideal reactors:
	* Batch reactor - Estimation of kinetic parameters for the saponification of ethylacetate
	*CSTR - Residence time distribution, reaction
	*CSTR in Series - Residence time distribution, reaction
	* Plug Flow Reactor - Residence time distribution, reaction
	Before the practical conduct of the experiments a colloquium takes place in which the students explain, reflect and discuss the theoretical basics and their translation into practice.
	The students write up a report for every experiment. They receive feedback to their level of scientific writing (citation methods, labeling of graphs, etc.), so that they can improve their competence in this field over the course of the practical course.
Literature	Levenspiel, O.: Chemical reaction engineering; John Wiley & Sons, New York, 3. Ed., 1999 VTM 309(LB)
	Praktikumsskript
	Skript Chemische Verfahrenstechnik 1 (F.Keil)



Courses				
ïtle		Тур	Hrs/wk	CP
ioprocess Engineering - Advanced (L110		Lecture	2	4
ioprocess Engineering - Advanced (L110		Recitation Section (small)	2	2
Module Responsible	Prof. An-Ping Zeng			
Admission Requirements	none			
Recommended Previous	Content of module "Biochemical Engineering I"			
Knowledge	After telice and acceptable, at all on the large and the fello	in a la province respublic		
Educational Objectives	After taking part successfully, students have reached the follo	wing learning results		
Professional Competence	After acceptable and the second of the secon			
Knowledge	After successful completion of this module, students should b	e able to		
	 describe and explain different kinetic approaches for 	growth and substrate-uptake		
	 identification of scientific problems with concrete indu 	strial use (cultivation of microorganisms and r	nammalian cells)	
	 describe and explain important downstreaming steps 	for proteins and their application as well as b	asic immobilization m	ethods
OL III.	A6	a alala ta		
Skills	After successful completion of this module, students should b	e able to		
	- to identifiy scientific questions or possible practical problet	ms for concrete industrial applications (eg cu	Itivation of microorga	nisms and animal cell
	and to formulate solutions,			
	- To assess the application of scale-up criteria for different ty	pes of bioreactors and processes and to appl	y these criteria to give	en problems (anaerob
	aerobic or microaerobically)			
	- to formulate questions for the analysis and optimization of re	ear biotechnological production processes app	propriate solutions,	
	- To describe the effects of the energy generation, the regene	ration of reduction equivalents, and the grow	th inhibition of the be	havior of microorganis
	and to the total fermentation process qualitatively	ration or readiction equivalents, and the grow		lavior or microorganisi
	,			
	- Establish material flow balance equations and solve them	to determine the kinetic parameters of differen	it approaches and to	calculate immobilizati
	and activity yields ,			
	- to select process control strategies (batch, fed-batch, contin	nuity) appropriately and to calculate basic tyr	nes and evaluate ther	n
	to solest process control strategies (satisfy, lea satisfy, control	ranty / appropriatory and to calculate basic typ	os ana evaluate then	
Personal Competence				
Social Competence	After completion of this module participants should be able	to debate technical questions in small teams	to enhance the abilif	v to take position to th
	own opinions and increase their capacity for teamwork.			,
	, ,			
Autonomy	After completion of this module participants are able to aquir	e new sources of knowledge and apply their	knowledge to previou	usly unknown issues a
	to present these.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min	tion Diagrams Faming of the Council		
Assignment for the Following	General Engineering Science (German program): Specialisa		nnulaanu	
Curricula	General Engineering Science (German program, 7 semester) Bioprocess Engineering: Core qualification: Compulsory	i. opecialisation Bioprocess Engineering: Cor	ipuisory	
	General Engineering Science (English program): Specialisat	ion Bioprocess Engineering: Compulsory		
	General Engineering Science (English program, 7 semester)		ıpulsorv	
	Technomathematics: Core qualification: Elective Compulsory		F	
	Technomathematics: Specialisation III. Engineering Science:			



Course L1107: Bioprocess Enginee	ring - Advanced
Тур	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. An-Ping Zeng, Prof. Andreas Liese, Dr. Wael Sabra
Language	DE
Cycle	WiSe
Content	 Introduction: state-of-the-art and development trends of microbial and biocatalytic bioprocesses, introduction to the lecture Enzymatic process I: reactor types and criteria for industrial biotransformations (Prof. Liese) Enzymatic process II (Prof. Liese) Immobilization technologies: basic methods for isoltaed enzymes/ cells (Prof. Liese) Anaerobic fermentation processes (Prof. Zeng) Microaerobic bioprocesses: kinetics, energetics, optimal O2-supply and scale-up (Prof. Zeng) Fedbatch process and cultivation with high cell density (Prof. Zeng) Downstream processing of protein bioproduction: basics of chromatography, membrane filtration (Prof. Liese) Cell culture technology and continuous culture: basics, kinetics, media, reactors (Prof. Zeng) Problem-based learning with selected bioprocesses (Prof. Liese, Prof. Zeng)
Literature	K. Buchholz, V. Kasche, U. Bornscheuer: Biocatalysts and Enzyme Technology, 2. Aufl. Wiley-VCH, 2012 H. Chmiel: Bioprozeßtechnik, Elsevier, 2006 R.H. Balz et al.: Manual of Industrial Microbiology and Biotechnology, 3. edition, ASM Press, 2010 H.W. Blanch, D. Clark: Biochemical Engineering, Taylor & Francis, 1997 P. M. Doran: Bioprocess Engineering Principles, 2. edition, Academic Press, 2013 Skripte für die Vorlesung

Course L1108: Bioprocess Enginee	ring - Advanced
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. An-Ping Zeng, Prof. Andreas Liese
Language	DE
Cycle	WiSe
Content	 Introduction: state-of-the-art and development trends of microbial and biocatalytic bioprocesses, introduction to the lecture Enzymatic process I: reactor types and criteria for industrial biotransformations (Prof. Liese) Enzymatic process II (Prof. Liese) Immobilization technologies: basic methods for isoltaed enzymes/ cells (Prof. Liese) Anaerobic fermentation processes (Prof. Zeng) Microaerobic bioprocesses: kinetics, energetics, optimal O2-supply and scale-up (Prof. Zeng) Fedbatch process and cultivation with high cell density (Prof. Zeng) Downstream processing of protein bioproduction: basics of chromatography, membrane filtration (Prof. Liese) Cell culture technology and continuous culture: basics, kinetics, media, reactors (Prof. Zeng) Problem-based learning with selected bioprocesses (Prof. Liese, Prof. Zeng) The students present exercises and discuss them with their fellow students and faculty statt. In the PBL part of the class the students discuss scientific questions in teams. They acquire knowledge and apply it to unknown questions, present their results and argue their opinions.
Literature	K. Buchholz, V. Kasche, U. Bornscheuer: Biocatalysts and Enzyme Technology, 2. Aufl. Wiley-VCH, 2012
	H. Chmiel: Bioproze Btechnik, Elsevier, 2006
	R.H. Balz et al.: Manual of Industrial Microbiology and Biotechnology, 3. edition, ASM Press, 2010
	H.W. Blanch, D. Clark: Biochemical Engineering, Taylor & Francis, 1997
	P. M. Doran: Bioprocess Engineering Principles, 2. edition, Academic Press, 2013
	Skripte für die Vorlesung



Courses	
ïtle	Typ Hrs/wk CP
ntroduction to Control Systems (L0654) ntroduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2
Module Responsible	Prof. Herbert Werner
Admission Requirements	none
Recommended Previous	Representation of signals and systems in time and frequency domain, Laplace transform
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second.
	systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.
	They can explain the role of the phase margin in analysis and synthesis of control loops
	They can explain the way a PID controller affects a control loop in terms of its frequency response
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally
Skills	
SKIIIS	Students can transform models of linear dynamic systems from time to frequency domain and vice versa
	They can simulate and assess the behavior of systems and control loops
	 They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules
	They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks
Personal Competence	
Social Competence	Students can work in small groups to jointly solve technical problems, and experimentally validate their controller designs
Autonomy	Students can obtain information from provided sources (lecture notes, software documentation, experiment guides) and use it when solving some solving
ŕ	problems.
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.
	They dan about them knowledge in workly on line total and altereby contact area to an industrial progress.
	They dan access their knowledge in recently on line tools and thereby control their realining progress.
	They can access their knowledge in reckly on line look and thereby control their localing progress.
	They can access their knowledge in reckly on line look and thereby control their localing progress.
Workload in Hours	
Workload in Hours Credit points	Independent Study Time 124, Study Time in Lecture 56
Credit points	Independent Study Time 124, Study Time in Lecture 56
Credit points Examination	Independent Study Time 124, Study Time in Lecture 56 6 Written exam
Credit points Examination Examination duration and scale	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Credit points Examination Examination duration and scale	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering,
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials i
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development an
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Display (Compulsory) General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productompulsory General Engineering Science (German progr
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compu
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program; Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialis
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Science; Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compu
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 8 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Domputer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Ingineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Ingineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Ricorpocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering,
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatrolal Sengineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering,
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Covil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechan
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mecha
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Envirormental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ingineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ingineering Science (Ingilis program, 7 semester): Special
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 8 Written exam 120 min General Engineering Science (German program; Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (Engilish program, 7 semeste



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

	ol Systems
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems
	Linear systems, differential equations and transfer functions
	First and second order systems, poles and zeros, impulse and step response
	Stability
	Feedback systems
	1 edulada systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Root locus techniques
	Root locus plots
	Root locus design of PID controllers
	Frequency response techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation
	Frequency response interpretation of PID control
	Time delay systems
	Root locus and frequency response of time delay systems
	Smith predictor
	Digital control
	Sampled-data systems, difference equations
	Tustin approximation, digital implementation of PID controllers
	Software tools
	a Jahradustian ta Mallah, Cincolial, Cantral ta alban
	Introduction to Matlab, Simulink, Control toolbox
	Computer-based exercises throughout the course
Literature	. Word II Lot of New Arts Control Control
	Werner, H., Lecture Notes "Introduction to Control Systems"
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009
	 K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010



Course L0655: Introduction to Control Systems	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M1275: Environme	ntal Technology			
Courses				
Title		Тур	Hrs/wk	CP
Practical Exercise Environmental Technol	ogy (L1387)	Laboratory Course	1	1
Environmental Technologie (L0326)		Lecture	2	2
Module Responsible	Dr. Joachim Gerth			
Admission Requirements	None			
Recommended Previous	Fundamentals of inorganic/organic chemistry and biology			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following I	earning results		
Professional Competence				
Knowledge	With the completion of this modul the students obtain profound k	nowledge of environmental technolo	gy. They are able to d	escribe the behaviour of
	chemicals in the environment. Students can give an overview of	scientific disciplines involved. They	can explain terms and	allocate them to related
	methods.			
01.71	Outline to the second of the s			data anti-contra da calcada de la contra d
Skills	Students are able to propose appropriate management and mitiga	·	•	•
	parameters and to assess the potential of pollutants to migrate			•
	Environmental Technology contributes to sustainable development	and they can present and detend the	ise opinons in front of a	nd against the group.
Personal Competence				
Social Competence	The students are able to discuss the various technical and scientifi	c tasks, both subject-specific and mu	tidisciplinary. They are	able to develop different
	approaches to the task as a group as well as to discuss their theore	tical or practical implementation.		
Autonomy	Students can independently exploit sources about of the subject, ac	Students can independently exploit sources about of the subject, acquire the particular knowledge and tranfer it to new problems.		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Examination	Written exam			
Examination duration and scale	1 hour written exam			
Assignment for the Following	General Engineering Science (German program): Specialisation Er	ergy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specialisation Pr	ocess Engineering: Elective Compuls	ory	
	General Engineering Science (German program, 7 semester): Spec	ialisation Energy and Enviromental E	ngineering: Compulsor	y
	General Engineering Science (German program, 7 semester): Spec	ialisation Process Engineering: Elect	ive Compulsory	
	General Engineering Science (German program, 7 semester): Spec	ialisation Bioprocess Engineering: El	ective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsory			
	Energy and Environmental Engineering: Core qualification: Compu	sory		
	General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory			
	General Engineering Science (English program): Specialisation Process Engineering: Elective Compulsory			
	General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory			
	General Engineering Science (English program, 7 semester): Spec	alisation Process Engineering: Electi	ve Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Elective Compulsory			
	Process Engineering: Core qualification: Elective Compulsory			

Course L1387: Practical Exercise Environmental Technology			
Тур	aboratory Course		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Dr. Joachim Gerth		
Language	DE		
Cycle	SoSe		
	The experiment demonstrates the effect of ionic strength on the binding of dissolved zinc and phosphate by soil surfaces. From the results it can be inferred that the potential of soil surfaces is modified by the application of salt. This has consequences for the retention of nutrients and pollutants. The experiment is carried out with iron oxide rich soil material. Within the lab course students discuss the various technical and scientific tasks, both subject-specific and multidisciplinary. They discuss different approaches to the task as well as it's theoretical or practical implementation.		
Literature	F. Scheffer und P. Schachtschabel (2002): "Lehrbuch der Bodenkunde" TUB Signatur AGG-308 W.E.H. Blum (2007): "Bodenkunde in Stichworten" TUB Signatur AGG-317 C. A. J. Appelo; D. Postma (2005): "Geochemistry, groundwater and pollution" TUB Signatur GWC-515		



Course L0326: Environmental Technologie		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Joachim Gerth, Prof. Martin Kaltschmitt, Prof. Kerstin Kuchta	
Language	DE	
Cycle	WiSe	
Content	1. Introductory seminar on environmental science: 2. Environmental impact and adverse effects 3. Wastewater technology 4. Air pollution control 5. Noise protection 6. Waste and recycling management 7. Soil and ground water protection 8. Renewable energies 9. Resource conservation and energy efficiency	
Literature	Förster, U.: Umweltschutztechnik; 2012; Springer Berlin (Verlag) 8., Aufl. 2012; 978-3-642-22972-5 (ISBN)	



Module M0539: Process an	d Plant Engineering I			
Courses				
Title		Тур	Hrs/wk	CP
Process and Plant Engineering I (L0095)		Lecture	2	2
Process and Plant Engineering I (L0096)		Recitation Section (large)	1	2
Process and Plant Engineering I (L1214)		Recitation Section (small)	1	2
Module Responsible	Prof. Georg Fieg			
Admission Requirements	none			
Recommended Previous	unit operation of thermal an dmechanical separation processes			
Knowledge	chemical reactor eingineering			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	students can:			
	classify and formulate blobal balance equations of chemical proc	esses		
	specify linear component equations of complex chemical process	es		
	explain linear regression and data reconcilliation problems			
	explain pfd-diagrams			
Skills	students are capable of	students are capable of		
	- formulation of mass and energy balance equations and estimati	on of product streams		
	- estimation of component streams of chemical plants using linea	r component balance models		
	- solution of data reconcilliation tasks			
	- conduction of process synthesis			
	- economic evaluation of processes and the estimation of product	ion costs		
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 Min. lectures notes and books			
Assignment for the Following	General Engineering Science (German program): Specialisation	Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Compul	sory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Bioprocess Engineering: Com	pulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Energy and Enviromental Eng	ineering: Elective Co	mpulsory
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation B			
	General Engineering Science (English program): Specialisation F	Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Spo			
	General Engineering Science (English program, 7 semester): Spo			
	General Engineering Science (English program, 7 semester): Spo	ecialisation Energy and Enviromental Engi	neering: Elective Co	mpulsory
	Process Engineering: Core qualification: Compulsory			

Course L0095: Process and Plant Engineering I		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Course work	none	
Lecturer	Prof. Georg Fieg	
Language	DE	
Cycle	SoSe	
Content	1. Introduction Structure and operation of production plants Operational business process Technical process design Motivation and targets of process development Life cycle of production plants 2. Engineering methods and tools Mass and energy balances Strategies of process synthesis Graphical representation of processes Multidimensional regression	



	Technische Universität Hamburg-Han
	Data reconciliation and data validation 3. Process Synthesis Decision levels Experimental process development Reactor synthesis Synthesis of separation processes (process alternatives and criteria for selection) Integration of reaction systems/separation systems (interactions, recycle streams) 4. Process safety 5. Cost estimation of production plants Production costs, capital costs, economic evaluation
Literature	
	S.D. Barnicki, J.R. Fair, Ind. End. Chem., 29(1990), S. 421, Ind. End. Chem., 31(1992), S. 1679
	H. Becker, S. Godorr, H. Kreis, Chemical Engineering, January 2001, S. 68-74
	Behr, W. Ebbers, N. Wiese, ChemIngTech. 72(2000)Nr. 10, S.1157
	E. Blass, Entwicklung verfahrenstechnischer Prozesse, Springer-Verlag, 2. Auflage 1997
	M. H. Bauer, J. Stichlmair, ChemIngTech., 68(1996), Nr. 8, 911-916
	R. Dittmeyer, W. Keim, G. Kreysa, A. Oberholz, Chemische Technik. Prozesse und Produkte,
	Band 2, Neue Technologien, 5. Auflage, Wiley-VCH GmbH&Co.KGaA, Weinheim, 2004
	J.M. Douglas, Conceptual Design of Chemical Processes, Mc Graw-Hill, NY, 1988
	G. Fieg, Inz. Chem. Proc., 5(1979), S.15-19
	G. Fieg, G. Wozny, L. Jeromin, Chem. Eng. Technol. 17(1994),5, 301-306
	G. Fieg, Heat and Mass Transfer 32(1996), S. 205-213
	G. Fieg, Chem. Eng. Processing, Vol. 41/2(2001), S. 123-133
	U.H. Felcht, Chemie eine reife Industrie oder weiterhin Innovationsmotor, Universitätsbuchhandlung Blazek und Bergamann, Frankfurt, 2000
	J.P. van Gigch, Systems Design, Modeling and Metamodeling, Plenum Press, New York, 1991
	T.F. Edgar, D.M. Himmelblau, L.S. Lasdon, Optimization of Chemical Processes, McGraw-Hill, 2001
	G. Gruhn, Vorlesungsmanuskript "Prozess- und Anlagentechnik, TU Hamburg-Harburg
	D. Hairston, Chemical Engineering, October 2001, S. 31-37
	J.L.A. Koolen, Design of Simple and Robust Process Plants, Wiley-VCH, Weinheim, 2002
	J. Krekel, G. Siekmann, ChemIngTech. 57(1985)Nr. 6, S. 511
	K. Machej, G. Fieg, J. Wojcik, Inz. Chem. Proc., 2(1981), S.815-824
	S. Meier, G. Kaibel, ChemIngTech. 62(1990)Nr. 13, S.169
	J. Mittelstraß, ChemIngTech. 66(1994), S. 309
	P. Li, M. Flender, K. Löwe, G. Wozny, G. Fieg, Fett/Lipid 100(1998), Nr. 12, S. 528-534
	G. Kaibel, Dissertation, TU München, 1987
	G. Kaibel, ChemIngTech. 61 (1989), Nr. 2, S. 104-112
1	

Course I 0096: Process and Plant Fi	ngineering I
	F. Lestak, C. Collins, Chemical Engineering, July 1997, S. 72-76
	H.J. Lang, Chem. Eng. 55(6), 112, 1948
	11.3. Lang, Orlent. Eng. 54(10),117, 1547

G. Kaibel, Chem. Eng. Technol., 10(1987), Nr. 2, S. 92-98

Course L0096: Process and Plant E	Course L0096: Process and Plant Engineering I	
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Course work	none	
Lecturer	Prof. Georg Fieg	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L1214: Process and Plant Engineering I	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Course work	none
Lecturer	Prof. Georg Fieg
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0670: Particle Tec	chnology and Solids Process Engineering			
-				
Courses				
Title		Тур	Hrs/wk	CP
Particle Technology I (L0434)		Lecture	2	3
Particle Technology I (L0435) Particle Technology I (L0440)		Recitation Section (small) Laboratory Course	1 2	1 2
Module Responsible	Prof. Stefan Heinrich	Laboratory Course	2	2
Admission Requirements	None			
Recommended Previous	keine			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	After successful completion of the module students are able to			
	name and explain processes and unit-operations of sol	ds process engineering		
	characterize particles, particle distributions and to discuss			
		p species		
Skills	Students are able to			
	choose and design apparatuses and processes for solic		s properties of the pro	oduct
	asses solids with respect to their behavior in solids proc	essing steps		
	 document their work scientifically. 			
Personal Competence				
Social Competence	The students are able to discuss scientific topics orally with other students or scientific personal and to develop solutions for technical-scientific issues in			
	a group.			
Autonomy	Students are able to analyze and solve questions regarding sol	id particles independently.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisatio	n Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisatio	n Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisatio	n Energy and Enviromental Engineering: Co	mpulsory	
	General Engineering Science (German program, 7 semester): S	Specialisation Process Engineering: Compu	Isory	
	General Engineering Science (German program, 7 semester): S	specialisation Bioprocess Engineering: Con	pulsory	
	General Engineering Science (German program, 7 semester): S	specialisation Energy and Enviromental Eng	ineering: Compulsor	у
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Cor	npulsory		
	General Engineering Science (English program): Specialisation	Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation		mpulsory	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S	pecialisation Energy and Enviromental Eng	ineering: Compulsor	/
	Process Engineering: Core qualification: Compulsory			



Course L0434: Particle Technology	l		
Тур	Lecture		
Hrs/wk			
CP	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Stefan Heinrich		
Language	DE		
Cycle	SoSe		
Content	Description of particles and particle distributions Description of a separation process Description of a particle mixture Particle size reduction Agglomeration, particle size enlargement Storage and flow of bulk solids Basics of fluid/particle flows classifying processes Separation of particles from fluids Basic fluid mechanics of fluidized beds Pneumatic and hydraulic transport		
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.		

Course L0435: Particle Technology	I
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0440: Particle Technology	l .
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	 Sieving Bulk properties Size reduction Mixing Gas cyclone Blaine-test, filtration Sedimentation
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.



Courses	
Title	Typ Hrs/wk CP
Introduction to Management (L0880)	Lecture 3 3
Project Entrepreneurship (L0882)	Problem-based Learning 2 3
Module Responsible	
Admission Requirements	
Recommended Previous Knowledge	
Educational Objectives	
Professional Competence	
Knowledge	
Skills	 explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions from field of Management explain the most important aspects of and goals in Management and name the most important aspects of entreprneurial projects describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and hur ressource management, information management, innovation management and marketing explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives and uncertainty, and exp some basic methods from mathematical Finance state basics from accounting and costing and selected controlling methods. Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry out Entrepreneurship project in a team. In particular, they are able to analyse Management goals and structure them appropriately analyse organisational and staff structures of companies apply methods for decision making under multiple objectives, under uncertainty and under risk analyse production and procurement systems and Business information systems analyse and apply basic methods of marketing select and apply basic methods from mathematical finance to predefined problems apply basic methods from accounting, costing and controlling to predefined problems
Personal Competence Social Competence	
Autonomy	 Students are able to work in a team and to organize the team themselves to write a report on their project.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	
Examination	
Examination duration and scale	
Assignment for the Following	
Curricula	
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Energy and Environmental Engineering: Compulsory
	General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compuls
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
	Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

ompulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

 $\label{thm:control_general} \textbf{General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory and Compulso$

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester); Specialisation Computer Science; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 $\label{thm:mechanical engineering:Core qualification:Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Тур	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga
Lecturer	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing
Literature	 Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008 Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003 Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006. Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001. Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008. Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005. Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008. Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Course L0882: Project Entrepreneu	rship
Тур	Problem-based Learning
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,
	using their knowledge from the corresponding lecture.
	Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Module M1274: Environme	ntal Technology			
Courses				
Title		Тур	Hrs/wk	СР
Environmental Assessment (L0860)		Lecture	2	2
Environmental Assessment (L1054)		Recitation Section (small)	1	1
Module Responsible	Prof. Martin Kaltschmitt	· ,		
Admission Requirements	None			
Recommended Previous	Fundamentals of inorganic/organic chemistry and biology			
Knowledge	The state of the s			
Educational Objectives	After taking part successfully, students have reached the fo	ollowing learning results		
Professional Competence	The aliming part decesses any, eladerne nave reaction and to	5.10 m.ng .00 m.ng .00 m.ng		
Knowledge	With the completion of this module the students acquire in	a-denth knowledge of important cause-effect ch	ains of notential enviro	nmental problems whi
Knowledge	might occur from production processes, projects or constru			
	in dealing with different methods and instruments to asset environmental processes as well as uncertainties and diffi		its are able to estimate	the complexity of the
Chille	·		-4	
Skills				
	solutions for managing and mitigating environmental pr			
	independently and can apply the software programs Open to critically judge research results or other publications on		g the course the stude	nts have the competen
	to critically judge research results of other publications of	environmental impacis.		
Personal Competence				
Social Competence	The students are able to discuss the various technical ar	nd scientific tasks, both subject-specific and mu	ultidisciplinary. They ar	re able to develop join
	different solutions and to discuss their theoretical or prac-	tical implementation. Due to the selected lectu	re topics, the students	receive insights into
	multi-layered issues of the environment protection and the	he concept of sustainability. Their sensitivity a	and consciousness tow	vards these subjects a
	raised and which helps to raise their awareness of their fut	ture social responsibilities in their role as engin	eers.	
Autonomy	The students learn to research, process and present a so	cientific topic independently. They are able to	carry out independent	scientific work. They ca
	solve an environmental problem in a business context and	d are able to judge results of other publications.		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Examination	Written exam			
Examination duration and scale	1 hour written exam			
Assignment for the Following	General Engineering Science (German program): Speciali	isation Energy and Environmental Engineering: (Compulsory	
Curricula	General Engineering Science (German program): Speciali			
2411104114	General Engineering Science (German program, 7 semes			v
	General Engineering Science (German program, 7 semes			,
	General Engineering Science (German program, 7 semes			
	Bioprocess Engineering: Core qualification: Elective Comp			
1	Energy and Environmental Engineering: Core qualification	•		
	General Engineering Science (English program): Specialis		Compulsory	
	General Engineering Science (English program): Specialis			
	General Engineering Science (English program, 7 semest		•	/
li di		,oatong, andtomonial	.gpaisor	
	General Engineering Science (English program 7 semest	er): Specialisation Process Engineering: Flective	e Compulsory	
	General Engineering Science (English program, 7 semest			
	General Engineering Science (English program, 7 semest General Engineering Science (English program, 7 semest Process Engineering: Core qualification: Elective Compuls	er): Specialisation Bioprocess Engineering: Ele		



Course L0860: Environmental Asse	ssment
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Anne Rödl, Dr. Christoph Hagen Balzer
Language	DE/EN
Cycle	SoSe
Content	Contaminants: Impact- and Risk Assessment
	Environmental damage & precautionary principle: Environmental Risk Assessment (ERA)
	Resource and water consumption: Material flow analysis
	Energy consumption: Cumulated energy demand (CED), cost analysis
	Life cycle concept: Life cycle assessment (LCA)
	Sustainability: Comprehensive product system assessment , SEE-Balance
	Management: Environmental and Sustainability management (EMAS)
	Complex systems: MCDA and scenario method
Literature	Foliensätze der Vorlesung
	Studie: Instrumente zur Nachhaltigkeitsbewertung - Eine Synopse (Forschungszentrum Jülich GmbH)

Course L1054: Environmental Asse	ssment
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Martin Kaltschmitt
Language	DE
Cycle	SoSe
Content	Presentation and application of free software programs in order to understand the concepts of environmental assessment methods better.
	Within the group exercise students discuss the various technical and scientific tasks, both subject-specific and multidisciplinary. They discuss different approaches to the task as well as it's theoretical or practical implementation.
Literature	Power point Präsentationen



Specialization Electrical Engineering

The educational objective of the General Engineering Science BSc program's electrical engineering specialization is to develop the ability to choose and combine fundamental methods and processes in order to solve technical tasks in engineering science and, especially, the specialization subject.

Graduates will have

- 1) A firm grounding in mathematics, physics, electrical engineering, and computer science
- 2) A basic knowledge of systems theory, control systems, and electrical power and energy or measurement technology
- 3) In-depth knowledge of engineering science areas, especially their specialization area (electrical engineering materials and components, semiconductor technology, communications engineering, electromagnetig theory). They will, in particular, have the methodological skills required for applying their knowledge to the solution of technical problems, taking technical, economic and societal requirements into account.

Module M0708: Electrical E	ngineering III: Circuit Theory and Transients			
Courses				
Title		Тур	Hrs/wk	СР
Circuit Theory (L0566)		Lecture	3	4
Circuit Theory (L0567)		Recitation Section (small)	2	2
Module Responsible	Prof. Arne Jacob			
Admission Requirements	none			
Recommended Previous	Electrical Engineering I and II, Mathematics I and II			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	Students are able to explain the basic methods for calculating e periodic signals. They know the methods for transient analysis of frequency behaviour and the synthesis of passive two-terminal-circ	of linear networks in time and in freque		
Skills	The students are able to calculate currents and voltages in linear able to calculate transients in electrical circuits in time and frequer analyse and to synthesize the frequency behaviour of passive two	ncy domain and are able to explain the r		
Personal Competence Social Competence	Students work on exercise tasks in small guided groups. They are	encouraged to present and discuss thei	r results within the gro	up.
Autonomy	The students are able to find out the required methods for solving lectures continuously by means of short-time tests. This allows the knowledge to other courses like Electrical Engineering I and Math	nem to control independently their educ		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	150 min			
Assignment for the Following	General Engineering Science (German program): Specialisation E	Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation M		onics: Compulsory	
	General Engineering Science (German program, 7 semester): Spe	ecialisation Mechanical Engineering, Fo	cus Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semester): Spe	ecialisation Electrical Engineering: Comp	oulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation E	lectrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation N	lechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (English program, 7 semester): Spe	cialisation Mechanical Engineering, Foo	us Mechatronics: Com	npulsory
	General Engineering Science (English program, 7 semester): Spe	cialisation Electrical Engineering: Comp	ulsory	
	Computational Science and Engineering: Specialisation Engineer	ring Sciences: Elective Compulsory		
	Mechatronics: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Elec	, ,		
	Technomathematics: Specialisation III. Engineering Science: Elec	tive Compulsory		



Course L0566: Circuit Theory	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Arne Jacob
Language	DE
Cycle	WiSe
Content	- Circuit theorems
	- N-port circuits
	- Periodic excitation of linear circuits
	- Transient analysis in time domain
	- Transient analysis in frequency domain; Laplace Transform
	- Frequency behaviour of passive one-ports
Literature	- M. Albach, "Grundlagen der Elektrotechnik 1", Pearson Studium (2011)
	- M. Albach, "Grundlagen der Elektrotechnik 2", Pearson Studium (2011)
	- L. P. Schmidt, G. Schaller, S. Martius, "Grundlagen der Elektrotechnik 3", Pearson Studium (2011)
	- T. Harriehausen, D. Schwarzenau, "Moeller Grundlagen der Elektrotechnik", Springer (2013)
	- A. Hambley, "Electrical Engineering: Principles and Applications", Pearson (2008)
	- R. C. Dorf, J. A. Svoboda, "Introduction to electrical circuits", Wiley (2006)
	- L. Moura, I. Darwazeh, "Introduction to Linear Circuit Analysis and Modeling", Amsterdam Newnes (2005)

Course L0567: Circuit Theory	
Тур	Recitation Section (small)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Arne Jacob
Language	DE
Cycle	WiSe
Content	see interlocking course
Literature	siehe korrespondierende Lehrveranstaltung
	see interlocking course



Module M0730: Computer			
Courses			
ïtle	Тур	Hrs/wk	CP
Computer Engineering (L0321)	Lecture	3	4
Computer Engineering (L0324)	Recitation Section (small)	1	2
Module Responsible			
Admission Requirements			
Recommended Previous Knowledge			
Knowedge	The successful completion of the labs will be honored during the evaluation of the module's examination according	g to the followin	g rules:
	Upon a passed module examination, the student is granted a bonus on the examination's marks due	to the success	sful labs, such that the
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge		assembly-level	programming down
· ·	gates. The module includes the following topics:	,	, ,
	. District		
	Introduction Combinational legis: Cates Replace clashes Replace functions bardware quethodic combinational nature.	orko	
	 Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational network Sequential logic: Flip-flops, automata, systematic hardware design 	UIKS	
	Technological foundations		
	Computer arithmetic: Integer addition, subtraction, multiplication and division		
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining		
	Memories: Memory hierarchies, SRAM, DRAM, caches		
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, but	sses	
Ckillo	The students perceive computer systems from the explitación perspective in they identify the internal structural	ture and the n	bysical campasition
SKIIIS	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structomputer systems. The students can analyze, how highly specific and individual computers can be built bas		
	components. They are able to distinguish between and to explain the different abstraction layers of today's comp		
	up to complete processors.	dung systems	nom gates and once
	· · · · · · · · · · · · · · · · · · ·		
	After successful completion of the module, the students are able to judge the interdependencies between a phys		
	executed on it. In particular, they shall understand the consequences that the execution of software has on the ha		•
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstra	iction levels nav	
	performance and to propose fossible entiage		re on an entire system
	performance and to propose feasible options.		e on an entire system
Personal Competence			e on an entire system
Personal Competence Social Competence			e on an entire system
Social Competence	Students are able to solve similar problems alone or in a group and to present the results accordingly.		e on an entire system
Social Competence Autonomy	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla		e on an entire system
Social Competence Autonomy Workload in Hours	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla		e on an entire system
Social Competence Autonomy Workload in Hours Credit points	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla		e on an entire system
Social Competence Autonomy Workload in Hours Credit points Examination	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla		e on an entire system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs		e on an entire system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory		e on an entire system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	isses.	e on an entire system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	isses.	e on an entire system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	isses.	e on an entitle system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	isses.	e on an entitle system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	y	e on an entire system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	y	e on an entire system
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	y	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering	y y y ng: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsor General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsor General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineerin General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	y y ng: Compulsory	pulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec	y y shatronics: Compulsory mechanics: Comraft Systems Eng	pulsory npulsory gineering: Compulso
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airca General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airca General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airca General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airca General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airca	y y shatronics: Compulsory mechanics: Comraft Systems Eng	pulsory npulsory gineering: Compulso
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airca General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory	y y shatronics: Compulsory mechanics: Comraft Systems Engs s Materials in	pulsory npulsory gineering: Compulso Engineering Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other clater lindependent Study Time 124, Study Time in Lecture 56 Mritten exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory	y y shatronics: Compulsory mechanics: Comraft Systems Engs s Materials in	pulsory npulsory gineering: Compulso Engineering Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airca General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory	y y ng: Compulsory shatronics: Com mechanics: Com raft Systems En s Materials in	pulsory npulsory gineering: Compulso Engineering Scienc echanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other class lindependent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airca General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foc	y y ng: Compulsory shatronics: Com mechanics: Com raft Systems En s Materials in	pulsory npulsory gineering: Compulso Engineering Science echanical Engineerin
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Eng	y y shatronics: Compulsory mechanics: Comraft Systems Eng s Materials in Theoretical Me	pulsory npulsory gineering: Compulso Engineering Science echanical Engineering pment and Production
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Comp	y y shatronics: Compulsory mechanics: Comraft Systems Eng s Materials in Theoretical Me	pulsory npulsory gineering: Compulso Engineering Science echanical Engineering pment and Production
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Eng	y y shatronics: Compulsory mechanics: Comraft Systems Eng s Materials in Theoretical Me	pulsory npulsory gineering: Compulso Engineering Scienc echanical Engineeri pment and Producti
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other clatering independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory Genera	y y shatronics: Compulsory mechanics: Comraft Systems Eng s Materials in Theoretical Me	pulsory npulsory gineering: Compulso Engineering Scienc echanical Engineeri pment and Producti
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other clater independent Study Time 124, Study Time in Lecture 56 Butten exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Scienc	y y shatronics: Compulsory mechanics: Comraft Systems Eng s Materials in Theoretical Me	pulsory npulsory gineering: Compulso Engineering Scienc echanical Engineeri pment and Producti
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other claim contents are able to acquire new knowledge from specific literature and to associate this knowledge with other claim claim contents of course and labs. General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomedical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomedical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airco General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical En	y y y g: Compulsory hatronics: Com mechanics: Corr raft Systems En s Materials in Theoretical Me	pulsory npulsory gineering: Compulso Engineering Scienc echanical Engineeri pment and Producti
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsor	y y y g: Compulsory hatronics: Com mechanics: Corr raft Systems En s Materials in Theoretical Me	pulsory npulsory gineering: Compulso Engineering Science echanical Engineering pment and Production
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla Independent Study Time 124, Study Time in Lecture 56 B Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Encompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Encompulsory Gen	y y y g: Compulsory hatronics: Com mechanics: Corr raft Systems En s Materials in Theoretical Me	pulsory npulsory gineering: Compulso Engineering Scienc echanical Engineeri pment and Producti
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other class independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Dioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engry and Environmental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bion General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Airc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ene Computery General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus	y y y g: Compulsory hatronics: Com mechanics: Corr raft Systems En s Materials in Theoretical Me	pulsory npulsory gineering: Compulso Engineering Scienc echanical Engineeri pment and Producti

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

General Engineering Science and Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	Introduction Combinational Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005.

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses				
Title Theoretical Electrical Engineering I: Time- Theoretical Electrical Engineering I: Time-		Typ Lecture Recitation Section (small)	Hrs/wk 3 2	CP 5
	Prof. Christian Schuster			
Admission Requirements	Elektrotechnik I, Elektrotechnik II, Mathematik I, Mathematik I	I, Mathematik III		
Recommended Previous Knowledge	Basic principles of electrical engineering and advanced mat	hematics		
Educational Objectives	After taking part successfully, students have reached the follo	owing learning results		
Professional Competence	2. 2. 2	-		
Knowledge	Students can explain the fundamental formulas, relations, a principal behavior of electrostatic, magnetostatic, and curr complex electromagnetic fields by means of superposition independent electromagnetic fields and are able to explicate	ent density fields with regard to respective of solutions for simple fields. The students ar	sources. They can de	escribe the properties
Skills	Students can apply Maxwell's Equations in integral notation in order to solve highly symmetrical, time-independent, electromagnetic field problem Furthermore, they are capable of applying a variety of methods that require solving Maxwell's Equations for more general problems. The students ca assess the principal effects of given time-independent sources of fields and analyze these quantitatively. They can deduce meaningful quantities for the characterization of electrostatic, magnetostatic, and electrical flow fields (capacitances, inductances, resistances, etc.) from given fields and dimension them for practical applications.			
Deve and Commetance				
Personal Competence Social Competence	Students are able to work together on subject related task sessions).	ks in small groups. They are able to presen	t their results effective	ely (e.g. during exerci
Autonomy	Students are capable to gather necessary information from provided references and relate this information to the lecture. They are able to continual reflect their knowledge by means of activities that accompany the lecture, such as short oral quizzes during the lectures and exercises that are related the exam. Based on respective feedback, students are expected to adjust their individual learning process. They are able to draw connections between their knowledge obtained in this lecture and the content of other lectures (e.g. Electrical Engineering I, Linear Algebra, and Analysis).			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90-150 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisa	ation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester	r): Specialisation Electrical Engineering: Comp	oulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program, 7 semester		ulsory	
	Technomathematics: Specialisation III. Engineering Science	: Elective Compulsory		



Course L0180: Theoretical Electrical	Il Engineering I: Time-Independent Fields
Тур	Lecture
Hrs/wk	3
СР	5
Workload in Hours	Independent Study Time 108, Study Time in Lecture 42
Lecturer	Prof. Christian Schuster
Language	DE .
Cycle	SoSe
Content	- Maxwell's Equations in integral and differential notation
	- Boundary conditions
	- Laws of conservation for energy and charge
	- Classification of electromagnetic field properties
	- Integral characteristics of time-independent fields (R, L, C)
	- Generic approaches to solving Poisson's Equation
	- Electrostatic fields and specific methods of solving
	- Magnetostatic fields and specific methods of solving
	- Fields of electrical current density and specific methods of solving
	- Action of force within time-independent fields
	- Numerical methods for solving time-independent problems
Literature	- G. Lehner, "Elektromagnetische Feldtheorie: Für Ingenieure und Physiker", Springer (2010)
	- H. Henke, "Elektromagnetische Felder: Theorie und Anwendung", Springer (2011)
	- W. Nolting, "Grundkurs Theoretische Physik 3: Elektrodynamik", Springer (2011)
	- D. Griffiths, "Introduction to Electrodynamics", Pearson (2012)
	- J. Edminister, " Schaum's Outline of Electromagnetics", Mcgraw-Hill (2013)
	- Richard Feynman, "Feynman Lectures on Physics: Volume 2", Basic Books (2011)



Course L0181: Theoretical Electrical	Il Engineering I: Time-Independent Fields
Тур	Recitation Section (small)
Hrs/wk	2
СР	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Christian Schuster
Language	DE
Cycle	SoSe
Content	- Maxwell's Equations in integral and differential notation
	- Boundary conditions
	- Laws of conservation for energy and charge
	- Classification of electromagnetic field properties
	- Integral characteristics of time-independent fields (R, L, C)
	- Generic approaches to solving Poisson's Equation
	- Electrostatic fields and specific methods of solving
	- Magnetostatic fields and specific methods of solving
	- Fields of electrical current density and specific methods of solving
	- Action of force within time-independent fields
	- Numerical methods for solving time-independent problems
Literature	- G. Lehner, "Elektromagnetische Feldtheorie: Für Ingenieure und Physiker", Springer (2010)
	- H. Henke, "Elektromagnetische Felder: Theorie und Anwendung", Springer (2011)
	- W. Nolting, "Grundkurs Theoretische Physik 3: Elektrodynamik", Springer (2011)
	- D. Griffiths, "Introduction to Electrodynamics", Pearson (2012)
	- J. Edminister, " Schaum's Outline of Electromagnetics", Mcgraw-Hill (2013)
	- Richard Feynman, "Feynman Lectures on Physics: Volume 2", Basic Books (2011)



ourses				
le		Time	Hrs/wk	CP
		Typ Lecture	пгs/wк 3	4
nals and Systems (L0432) nals and Systems (L0433)		Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch		· ·	
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge	Mathematics 1-3			
Momeage	The modul is an introduction to the theory of signals and systems: Further experience with spectral transformations (Fourier series, Fo			nematik 1-3 is expe
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and linear t	ime-invariant (LTI) systems using metho	ods of signal and syste	em theory. They are
	to apply the fundamental transformations of continuous-time and $\ensuremath{\text{d}}$	screte-time signals and systems. They	can describe and anal	yse deterministic si
	and systems mathematically in both time and image domain. In	particular, they understand the effects	in time domain and ir	mage domain which
	caused by the transition of a continuous-time signal to a discrete-time	ne signal.		
Skills	The students are able to describe and analyse deterministic signal	ls and linear time-invariant systems usi	ng methods of signal	and system theory.
	can analyse and design basic systems regarding important prope	rties such as magnitude and phase res	ponse, stability, linear	ity etc They can as
	the impact of LTI systems on the signal properties in time and frequ	ency domain.		
Personal Competence				
Social Competence	The students can jointly solve specific problems.			
Autonomy	The students are able to acquire relevant information from appropriate the students are able to acquire relevant information from appropriate the students are able to acquire relevant information from appropriate the students are able to acquire relevant information from appropriate the students are able to acquire relevant information from appropriate the students are able to acquire relevant information from appropriate the students are able to acquire relevant information from appropriate the students are able to acquire relevant information from appropriate the students are able to acquire relevant information from appropriate the students are able to acquire relevant information from appropriate the students are also acquired to the studen	priate literature sources. They can cont	rol their level of know	ledge during the le
´	period by solving tutorial problems, software tools, clicker system.	,		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
	6			
·	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation E			
Curricula	General Engineering Science (German program): Specialisation C			
	General Engineering Science (German program): Specialisation P			
	General Engineering Science (German program): Specialisation B			
	General Engineering Science (German program): Specialisation C		mpulsory	
	General Engineering Science (German program): Specialisation M			
	General Engineering Science (German program): Specialisation B	iomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Spe	cialisation Electrical Engineering: Comp	oulsory	
	General Engineering Science (German program, 7 semester): Spe	cialisation Computer Science: Compuls	ory	
	General Engineering Science (German program, 7 semester): Spe	cialisation Process Engineering: Compu	ulsory	
	General Engineering Science (German program, 7 semester): Spe	cialisation Bioprocess Engineering: Cor	mpulsory	
	General Engineering Science (German program, 7 semester): Spe	cialisation Biomedical Engineering: Cor	mpulsory	
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering, Foo	cus Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering, Foo	cus Energy Systems: C	Compulsory
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering, Foo	cus Aircraft Systems Er	ngineering: Compul
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering	g, Focus Materials in	Engineering Scie
	Compulsory			
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering, Foo	cus Mechatronics: Con	npulsory
	General Engineering Science (German program, 7 semester): S	Specialisation Mechanical Engineering	, Focus Theoretical M	Mechanical Engine
	Compulsory			-
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Ci	vil- and Enviromental Engeneering: Cor	mpulsory	
	General Engineering Science (English program): Specialisation Bi			
	General Engineering Science (English program): Specialisation El			
	General Engineering Science (English program): Specialisation Co	0 0 1 7		
	General Engineering Science (English program): Specialisation Me			
	General Engineering Science (English program): Specialisation Bi			
	General Engineering Science (English program): Specialisation Pr			
	General Engineering Science (English program, 7 semester): Spec		ulsory	
	General Engineering Science (English program, 7 semester): Spec		•	
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): Spec			npulsorv
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): Spec General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): S	эреманзация месналисы Engineering	y, rocus ivialeriais In	Linging enting Scie
	Compulsory General Engineering Science (English program, 7 semester): Spec	vialication Machanical Engineering For	ue Machatranias C	nuleon,
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): S	specialisation wechanical Engineering.	, rocus medical iv	lechanical Enginee
	Compulsory Computational Science and Engineering: Core qualification: Comp		, rocus medical w	nechanical Enginee



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	S
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
	Basic classification and description of continuous-time and discrete-time signals and systems
	Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)
	Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke, Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

Course L0433: Signals and Systems	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0748: Materials in	Electrical Engineering			
Courses				
Title		Тур	Hrs/wk	CP
Electrotechnical Experiments (L0714)		Lecture	1	1
Materials in Electrical Engineering (L0685)		Lecture	2	3
Materials in Electrical Engineering (Problem	m Solving Course) (L0687)	Recitation Section (small)	2	2
Module Responsible	Prof. Manfred Eich			
Admission Requirements	None			
Recommended Previous	Highschool level physics and mathematics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the followi	ng learning results		
Professional Competence				
Knowledge	Students can explain the composition and the structural prope mechanical, electrical, thermal, dielectric, magnetic and chemic	_	-	•
Skills	Students can identify appropriate descriptive models and ap- influential on the performance of materials in electrical enginee		erive approximative solu	utions and judge factors
Personal Competence Social Competence	Students can jointly solve subject related problems in groups course.	. They can present their results effectiv	ely within the framewor	k of the problem solving
Autonomy	Students are capable to extract relevant information from the preflect their acquired level of expertise with the help of lecture connect their knowledge with that acquired from other lectures.			•
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisatio	n Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): S	Specialisation Electrical Engineering: Co	mpulsory	
	Electrical Engineering: Core qualification: Compulsory	-	•	
	General Engineering Science (English program): Specialisation	n Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): S	pecialisation Electrical Engineering: Cor	mpulsory	
	Computational Science and Engineering: Specialisation Engine		•	



Course L0714: Electrotechnical Experiments	
Тур	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Wieland Hingst
	DE
Cycle	SoSe
Content	Agenda:
	- Natural sources of electricity
	- Oscilloscope
	- Characterizing signals
	- 2 terminal circuit elements
	- 2-ports
	- Power
	- Matching
	- Inductive coupling
	- Resonance
	- Radio frequencies
	- Transistor circuits
	- Electrical measurement
	- Materials for the EE
	- Electrical fun
Literature	Tietze, Schenk: "Halbleiterschaltungstechnik", Springer



Course L0685: Materials in Electrica	al Engineering
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Manfred Eich
Language	DE
Cycle	SoSe
Content	The Hamiltonian approach to classical mechanics. Analysis of a simple oscillator.
	Analysis of vibrations in a one-dimensional lattice.
	Phononic bandgap
	Introduction to quantum mechanics
	Wave function, Schrödinger's equation, observables and measurements.
	Quantum mechanical harmonic oscillator and spectral decomposition. Symmetries, conserved quantities, and the labeling of states.
	Angular momentum
	The hydrogen atom
	Waves in periodic potentials
	Reciprocal lattice and reciprocal lattice vectors
	Band gap
	Band diagrams
	The free electron gas and the density of states
	Fermi-Dirac distribution
	Density of charge carriers in semiconductors Conductivity in complement of the property of th
	Conductivity in semiconductors. Engineering conductivity through doping. The P-N junction (diode)
	Light emitting diodes
	Electromagnetic waves interacting with materials
	Reflection and refraction
	Photonic band gaps
	Origins of magnetization
	Hysteresis in ferromagnetic materials
	Magnetic domains
Literature	1.Anikeeva, Beach, Holten-Andersen, Fink, Electronic, Optical and Magnetic Properties of Materials,
	Massachusetts Institute of Technology (MIT), 2013
	2.Hagelstein et al., Introductory Applied Quantum and Statistical Mechanics, Wiley 2004
	3.Griffiths, Introduction to Quantum Mechanics, Prentice Hall, 1994
	4.Shankar, Principles of Quantum Mechanics, 2nd ed., Plenum Press, 1994
	5.Fick, Einführung in die Grundlagen der Quantentheorie, Akad. Verlagsges., 1979
	6.Kittel, Introduction to Solid State Physics, 8th ed., Wiley, 2004
	7.Ashcroft, Mermin, Solid State Physics, Harcourt, 1976
	8.Pierret, Semiconductor Fundamentals Vol. 1, Addison Wesley, 1988
	9.Sze, Physics of Semiconductor Devices, Wiley, 1981
	10.Saleh, Teich, Fundamentals of Photonics, 2nd ed., 2007
	11. Joannopoulos, Johnson, Winn Meade, Photonic Crystals, 2nd ed., Princeton Universty Press, 2008
	12.Handley, Modern Magnetic Materials, Wiley, 2000
	13.Wikipedia, Wikimedia



Course L0687: Materials in Electrical Engineering (Problem Solving Course)	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Manfred Eich
Language	DE
Cycle	SoSe
Content	Atom structure and periodic system Atom binding and crystal structure Structure and properties of alloys: diffusion, phase diagrams, phase separation and grain boundaries Material properties: Mechanical, thermal, electrical, dielectric properties Metals Semiconductors Ceramics and glasses Polymers Magnetic materials Electrochemistry Oxidation numbers, electrolysis, batteries, fuel cells
Literature	H. Schaumburg: Einführung in die Werkstoffe der Elektrotechnik, Teubner (1993)



Module M0709: Electrical E	ngineering IV: Transmission Lines and	Research Seminar		
Courses				
Title		Тур	Hrs/wk	CP
Research Seminar Electrical Engineering,	Computer Science Mathematics (L0571)	Seminar	2 2	2
Transmission Line Theory (L0570)	competer concrete, mathematics (2007.7)	Lecture	2	3
Transmission Line Theory (L0572)		Recitation Section (large)	2	1
Module Responsible	Prof. Arne Jacob			
Admission Requirements	none			
Recommended Previous	Electrical Engineering I-III, Mathematics I-III			
Knowledge				
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	Students can explain the fundamentals of wave pro	pagation on transmission lines at low and high fre	quencies. They are ab	le to analyze circuits with
	transmission lines in time and frequency domain. The	ney can describe simple equivalent circuits of tran	smission lines. They ar	re able to solve problems
	with coupled transmission lines. They can present an	d discuss a self-chosen research topic.		
Skills	Students can analyze and calculate the propagation	of waves in simple circuits with transmission line	s. They are able to ana	alyze circuits in frequency
	domain and with the Smith chart. They can analyze	ze equivalent circuits of transmission lines. They	are able to solve pro	blems including coupled
	transmission lines using the vectorial transmission lir	e equations. They are able to give a talk to profess	ionals.	
Personal Competence				
Social Competence	Students can analyze and solve problems in small	groups and discuss their solutions. They can com	pare the learned theor	y with experiments in the
•	lecture and discuss it in small groups. They are able	to present a research topic to professionals and dis	cuss it with them.	
Autonomy	The students can solve problems by their own and	are able to acquire skills from the lecture and the	literature. They are ab	le to test their knowledge
	using computer animations. They can test their level	of knowledge by answering short questions and tes	its during the lecture. Th	ney are able to relate their
	acquired knowledge to other lectures (e.g. Electrical	Engineering I-III and Mathematics I-III). They can	familiarize themselves	with a research topic and
	can prepare a presentation.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 8-	4		
Credit points	6			
Examination	Written exam			
Examination duration and scale	150 min			
Assignment for the Following	General Engineering Science (German program): Sp	ecialisation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 se	emester): Specialisation Electrical Engineering: Co	mpulsory	
	Electrical Engineering: Core qualification: Compulso	у		
	General Engineering Science (English program): Spe	ecialisation Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 se	mester): Specialisation Electrical Engineering: Cor	npulsory	
	Computational Science and Engineering: Specialisate			
	Technomathematics: Specialisation III. Engineering S	• •		
	Technomathematics: Core qualification: Elective Con	npulsory		

Course L0571: Research Seminar Electrical Engineering, Computer Science, Mathematics	
Тур	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dozenten des SD E
Language	DE/EN
Cycle	SoSe
Content	Seminar talk on a given subject
Literature	Themenabhängig / subject related



Course L0570: Transmission Line Theory		
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Arne Jacob	
Language	DE	
Cycle	SoSe	
Content	- Wave propagation along transmission lines - Transient behavior of transmission lines - Transmission lines in steady state - Impedance transformation and Smith chart	
	- Equivalent circuits - Coupled transmission lines and symmetrical components	
Literature	- Unger, HG., "Elektromagnetische Wellen auf Leitungen", Hüthig Verlag (1991)	

Course L0572: Transmission Line Theory	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Arne Jacob
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0854: Mathematic	s IV			
Courses				
Title Title		Тур	Hrs/wk	СР
Differential Equations 2 (Partial Differential	Equations) (L1043)	Lecture	2	1
Differential Equations 2 (Partial Differential	Equations) (L1044)	Recitation Section (small)	1	1
Differential Equations 2 (Partial Differential	Equations) (L1045)	Recitation Section (large)	1	1
Complex Functions (L1038)		Lecture	2	1
Complex Functions (L1041)		Recitation Section (small)	1	1
Complex Functions (L1042)		Recitation Section (large)	1	1
Module Responsible	Prof. Anusch Taraz			
Admission Requirements	none			
Recommended Previous	Mathematics 1 - III			
Knowledge	Watternatios 1 - III			
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	Ot all the second of the back and the second of the Market	Con N/ The control of the control of the control of		
	Students can name the basic concepts in Mathem			
	Students can discuss logical connections between		nese connections w	ith the help of exampl
	 They know proof strategies and can reproduce th 	em.		
Skills				
OKIIIS	Students can model problems in Mathematics IV	with the help of the concepts studied in this course	e. Moreover, they are	capable of solving the
	by applying established methods.			
		gical connections between the concepts studied in	the course	
	For a given problem, the students can develop an	•		aulta
	For a given problem, the students can develop at	id execute a suitable approach, and are able to chi	ically evaluate the re	ssuits.
Personal Competence				
Social Competence				
coolai competence	 Students are able to work together in teams. They 	are capable to use mathematics as a common lan	guage.	
	 In doing so, they can communicate new concept 	s according to the needs of their cooperating part	ners. Moreover, they	can design example
	check and deepen the understanding of their pee		, ,	,
	check and deepen the understanding of their pee	10.		
Autonomy				
	 Students are capable of checking their understand 	nding of complex concepts on their own. They cal	n specify open ques	tions precisely and ki
	where to get help in solving them.			
	 Students have developed sufficient persistence to 	be able to work for longer periods in a goal-orient	ed manner on hard	oroblems.
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 min (Complex Functions) + 60 min (Differential Equation)			
Assignment for the Following	General Engineering Science (German program): Specia	alisation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specia	alisation Mechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (German program): Specia	alisation Mechanical Engineering, Focus Theoretic	al Mechanical Engin	eering: Compulsory
	General Engineering Science (German program): Specia	alisation Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 seme	' '	ılsorv	
			-	mnuleon;
	General Engineering Science (German program, 7 seme			
	General Engineering Science (German program, 7 se	mester): Specialisation Mechanical Engineering,	rocus Ineoretical I	wecnanical Engineer
	Compulsory			
	General Engineering Science (German program, 7 seme	ster): Specialisation Naval Architecture: Compulso	ry	
	Computer Science: Specialisation Computational Mather	matics: Elective Compulsory		
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specia	lisation Flectrical Engineering: Compulsory		
	General Engineering Science (English program): Specia	• •		
	General Engineering Science (English program): Specia	lisation Mechanical Engineering, Focus Mechatron	ics: Compulsory	
	General Engineering Science (English program): Specia	lisation Mechanical Engineering, Focus Theoretica	l Mechanical Engine	eering: Compulsory
	General Engineering Science (English program, 7 semes	ster): Specialisation Electrical Engineering: Compu	Isory	
	General Engineering Science (English program, 7 seme			npulsory
	General Engineering Science (English program, 7 ser			
			. Jour moorewal I	conamoar Engineer
	Compulsory			
	General Engineering Science (English program, 7 semes	ster): Specialisation Naval Architecture: Compulsor	У	
	Computational Science and Engineering: Specialisation	Engineering Sciences: Elective Compulsory		
	Computational Science and Engineering: Specialisation	Computer Science: Elective Compulsory		
	Mechanical Engineering: Specialisation Theoretical Mec			
	Mechanical Engineering: Specialisation Mechatronics: C	ompaisory		
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			



Course L1043: Differential Equations 2 (Partial Differential Equations)		
Тур	Lecture	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	Main features of the theory and numerical treatment of partial differential equations	
	 Examples of partial differential equations First order quasilinear differential equations Normal forms of second order differential equations Harmonic functions and maximum principle Maximum principle for the heat equation Wave equation Liouville's formula Special functions Difference methods Finite elements 	
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html	

Course L1044: Differential Equation	Course L1044: Differential Equations 2 (Partial Differential Equations)		
Тур	Typ Recitation Section (small)		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Dozenten des Fachbereiches Mathematik der UHH		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Course L1045: Differential Equations 2 (Partial Differential Equations)	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1038: Complex Functions		
Тур	Lecture	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	Main features of complex analysis	
	Functions of one complex variable Complex differentiation Conformal mappings Complex integration Cauchy's integral theorem Cauchy's integral formula Taylor and Laurent series expansion Singularities and residuals Integral transformations: Fourier and Laplace transformation	
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html	



Course L1041: Complex Functions	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1042: Complex Functions	
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0675: Introduction	n to Communications and Random Processes			
Courses				
Title		Тур	Hrs/wk	СР
Introduction to Communications and Rand	om Processes (L0442)	Lecture	3	4
Introduction to Communications and Rand	om Processes (L0443)	Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch			
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge				
	Signals and Systems			
	Basic knowledge of probability theory			
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	The students know and understand the fundamental building blo	cks of a communications system. They	can describe and analy	se the individual building
	blocks using knowledge of signal and system theory as well a	as the theory of stochastic processes.	The are aware of the	essential resources and
	evaluation criteria of information transmission and are able to des	sign and evaluate a basic communication	ons system.	
Skills	The students are able to design and evaluate a basic communications system. In particular, they can estimate the required resources in terms of			
	bandwidth and power. They are able to assess essential evalua	tion parameters of a basic communica	tions system such as b	andwidth efficiency or bit
	error rate and to decide for a suitable transmission method.			
Personal Competence				
Social Competence	The students can jointly solve specific problems.			
Autonomy	The students are able to acquire relevant information from appr	opriate literature sources. They can co	ntrol their level of know	vledge during the lecture
	period by solving tutorial problems, software tools, clicker system	•		0 0
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Sp	0 0	mpulsory	
	Computer Science: Specialisation Computer and Software Engin	eering: Elective Compulsory		
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation I			
	General Engineering Science (English program, 7 semester): Sp		npulsory	
	Computational Science and Engineering: Specialisation Engineer			
	Technomathematics: Specialisation III. Engineering Science: Elec	ctive Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			



Course L0442: Introduction to Comm	nunications and Random Processes
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	WiSe
00	Fundamentals of random processes
	Introduction to communications engineering
	Quadrature amplitude modulation
	Description of radio frequency transmission in the equivalent complex baseband
	Transmission channels, channel models
	Analog digital conversion: Sampling, quantization, pulsecode modulation (PCM)
	Fundamentals of information theory, source coding, channel coding
	Digital baseband transmission: Pulse shaping, eye diagramm, 1. and 2. Nyquist condition, matched filter, detection, error probability
	Fundamentals of digital modulation
Literature	K. Kammeyer: Nachrichtenübertragung, Teubner
	P.A. Höher: Grundlagen der digitalen Informationsübertragung, Teubner.
	M. Bossert: Einführung in die Nachrichtentechnik, Oldenbourg.
	J.G. Proakis, M. Salehi: Grundlagen der Kommunikationstechnik. Pearson Studium.
	J.G. Proakis, M. Salehi: Digital Communications. McGraw-Hill.
	S. Haykin: Communication Systems. Wiley
	J.G. Proakis, M. Salehi: Communication Systems Engineering. Prentice-Hall.
	J.G. Proakis, M. Salehi, G. Bauch, Contemporary Communication Systems. Cengage Learning.

Course L0443: Introduction to Communications and Random Processes	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses				
litle little		Тур	Hrs/wk	СР
Theoretical Electrical Engineering II: Time-Dependent Fields (L0182)		Lecture	3	5
Theoretical Electrical Engineering II: Time-	Dependent Fields (L0183)	Recitation Section (small)	2	1
Module Responsible	Prof. Christian Schuster			
Admission Requirements	None			
	Electrical Engineering I, Electrical Engineering II, Theor	etical Electrical Engineering I		
Knowledge	Mathematics I, Mathematics II, Mathematics III, Mathemati	atics IV		
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge				
Skills	Students are able to apply a variety of procedures in order to solve the diffusion and the wave equation for general time-dependent field problems. They can assess the principal effects of given time-dependent sources of fields and analyze these quantitatively. They can deduce meaningful quantities to the characterization of fully dynamic fields (wave impedance, skin depth, Poynting-vector, radiation resistance, etc.) from given fields and interpret them with regard to practical applications.			
Personal Competence Social Competence	Students are able to work together on subject related sessions).	t tasks in small groups. They are able to prese	ent their results effective	ely (e.g. during exerc
Autonomy	Students are capable to gather necessary information from provided references and relate this information to the lecture. They are able to continually reflect their knowledge by means of activities that accompany the lecture, such as short oral quizzes during the lectures and exercises that are related to the exam. Based on respective feedback, students are expected to adjust their individual learning process. They are able to draw connections between acquired knowledge and ongoing research at the Hamburg University of Technology (TUHH), e.g. in the area of high frequency engineering and optics.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90-150 minutes			
Assignment for the Following	General Engineering Science (German program): Spec	ialisation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 sem		mpulsory	
	Electrical Engineering: Core qualification: Compulsory	3 3	· •	
	General Engineering Science (English program): Speci	alisation Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 sem		npulsory	
	Technomathematics: Specialisation III. Engineering Sci			



Course L0182: Theoretical Electrical	Il Engineering II: Time-Dependent Fields
Тур	Lecture
Hrs/wk	3
CP	5
Workload in Hours	Independent Study Time 108, Study Time in Lecture 42
Lecturer	Prof. Christian Schuster
Language	DE
Cycle	WiSe
Content	- Theory and principal characteristics of quasistationary electromagnetic fields
	- Electromagnetic induction and law of induction
	- Skin effect and eddy currents
	- Shielding of time variable magnetic fields
	- Theory and principal characteristics of fully dynamic electromagnetic fields
	- Wave equations and properties of planar waves
	- Polarization and superposition of planar waves
	- Reflection and refraction of planar waves at boundary surfaces
	- Waveguide theory
	- Rectangular waveguide, planar optical waveguide
	- Elektrical and magnetical dipol radiation
	- Simple arrays of antennas
Literature	- G. Lehner, "Elektromagnetische Feldtheorie: Für Ingenieure und Physiker", Springer (2010)
	- H. Henke, "Elektromagnetische Felder: Theorie und Anwendung", Springer (2011)
	- W. Nolting, "Grundkurs Theoretische Physik 3: Elektrodynamik", Springer (2011)
	- D. Griffiths, "Introduction to Electrodynamics", Pearson (2012)
	- J. Edminister, "Schaum's Outline of Electromagnetics", Mcgraw-Hill (2013)
	- Richard Feynman, "Feynman Lectures on Physics: Volume 2", Basic Books (2011)



Course L0183: Theoretical Electrical	Il Engineering II: Time-Dependent Fields
Тур	Recitation Section (small)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Christian Schuster
Language	DE
Cycle	WiSe
Content	- Theory and principal characteristics of quasistationary electromagnetic fields
	- Electromagnetic induction and law of induction
	- Skin effect and eddy currents
	- Shielding of time variable magnetic fields
	- Theory and principal characteristics of fully dynamic electromagnetic fields
	- Wave equations and properties of planar waves
	- Polarization and superposition of planar waves
	- Reflection and refraction of planar waves at boundary surfaces
	- Waveguide theory
	- Rectangular waveguide, planar optical waveguide
	- Elektrical and magnetical dipol radiation
	- Simple arrays of antennas
Literature	- G. Lehner, "Elektromagnetische Feldtheorie: Für Ingenieure und Physiker", Springer (2010)
	- H. Henke, "Elektromagnetische Felder: Theorie und Anwendung", Springer (2011)
	- W. Nolting, "Grundkurs Theoretische Physik 3: Elektrodynamik", Springer (2011)
	- D. Griffiths, "Introduction to Electrodynamics", Pearson (2012)
	- J. Edminister, "Schaum's Outline of Electromagnetics", Mcgraw-Hill (2013)
	- Richard Feynman, "Feynman Lectures on Physics: Volume 2", Basic Books (2011)



Module M1235: Electrical P	ower Systems I			
Courses				
Title		Тур	Hrs/wk	СР
Electrical Power Systems I (L1670)		Lecture	3	4
Electrical Power Systems I (L1671)		Recitation Section (large)	2	2
Module Responsible	Prof. Christian Becker			
Admission Requirements	none			
Recommended Previous	Fundamentals of Electrical Engineering			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	Students are able to give an overview of conventional and	d modern electric power systems. They	can explain in detai	I and critically evaluate
	technologies of electric power generation, transmission, storag	e, and distribution as well as integration of	equipment into electric	power systems.
Claite	Maria a a contrata a c			
Skills	With completion of this module the students are able to apply t	ne acquired skills in applications of the de	isign, integration, devei	opment of electric power
	systems and to assess the results.			
Personal Competence				
Social Competence	The students can participate in specialized and interdisciplinary	y discussions, advance ideas and represe	nt their own work result	s in front of others.
Autonomy	Students can independently tap knowledge of the emphasis of	the lectures.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 - 150 minutes			
Assignment for the Following	General Engineering Science (German program, 7 semester):	Specialisation Electrical Engineering: Elec	tive Compulsory	
Curricula	Electrical Engineering: Core qualification: Elective Compulsory			
	Energy and Environmental Engineering: Specialisation Energy	Engineering: Elective Compulsory		
	Energy Systems: Specialisation Energy Systems: Elective Com	pulsory		
	Energy Systems: Specialisation Energy Systems: Elective Com	pulsory		
	General Engineering Science (English program, 7 semester): S	Specialisation Electrical Engineering: Elect	tive Compulsory	
	Computational Science and Engineering: Specialisation Engin	eering Sciences: Elective Compulsory		
	Renewable Energies: Core qualification: Compulsory			



Course L1670: Electrical Power Sys	tems I
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Christian Becker
Language	DE .
Cycle	WiSe
Content	
	 fundamentals and current development trends in electric power engineering
	tasks and history of electric power systems
	symmetric three-phase systems
	fundamentals and modelling of eletric power systems
	• lines
	• transformers
	synchronous machines
	 grid structures and substations
	fundamentals of energy conversion
	electro-mechanical energy conversion
	thermodynamics
	 power station technology
	 renewable energy conversion systems
	on-board electrical power systems
	steady-state network calculation
	network modelling
	 load flow calculation
	• (n-1)-criterion
	symmetric failure calculations, short-circuit power
	asymmetric failure calculation
	symmetric components
	 calculation of asymmetric failures
	control in networks and power stations
	insulation coordination and protection
	grid planning
	power economy fundamentals
Literature	K. Heuck, KD. Dettmann, D. Schulz: "Elektrische Energieversorgung", Vieweg + Teubner, 9. Auflage, 2014
	A. J. Schwab: "Elektroenergiesysteme", Springer, 3. Auflage, 2012
	R. Flosdorff: "Elektrische Energieverteilung" Vieweg + Teubner, 9. Auflage, 2005



Course L1671: Electrical Power Sys	stems I
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Christian Becker
Language	DE
Cycle	WiSe
Content	fundamentals and current development trends in electric power engineering
	tasks and history of electric power systems
	symmetric three-phase systems
	fundamentals and modelling of eletric power systems
	• lines
	• transformers
	• synchronous machines
	grid structures and substations
	fundamentals of energy conversion electro-mechanical energy conversion
	thermodynamics
	power station technology
	renewable energy conversion systems
	on-board electrical power systems
	steady-state network calculation
	network modelling
	load flow calculation
	o (n-1)-criterion
	symmetric failure calculations, short-circuit power
	asymmetric failure calculation
	symmetric components
	calculation of asymmetric failures
	control in networks and power stations
	insulation coordination and protection
	grid planning
	power economy fundamentals
Literature	K. Heuck, KD. Dettmann, D. Schulz: "Elektrische Energieversorgung", Vieweg + Teubner, 9. Auflage, 2014
1	A. J. Schwab: "Elektroenergiesysteme", Springer, 3. Auflage, 2012
	R. Flosdorff: "Elektrische Energieverteilung" Vieweg + Teubner, 9. Auflage, 2005



Module M0760: Electronic	Devices			
Courses				
Title		Тур	Hrs/wk	CP
Electronic Devices (L0720)		Lecture	3	4
Electronic Devices (L0721)		Problem-based Learning	2	2
Module Responsible	Prof. Hoc Khiem Trieu			
Admission Requirements	None			
Recommended Previous	Atomic model and quantum theory, electrical currents in solid state	materials, basics in solid-state physics		
Knowledge	Successful participation of Physics for Engineers and Materials in	Electrical Engineering or courses with a	uivalent contente	
	Succession participation of Physics for Engineers and Materials III	Electrical Engineering of courses with ec	quivalent contents	
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge				
	Students are able			
	to represent the basics of semiconductor physics,			
	to explain the operating principle of important semiconduction.	or devices,		
	to outline device characteristics and equivalent circuits as	well as to explain their derivation and		
	to discuss the limitation of device models.			
Skills				
	Students are capable			
	to apply devices in basic circuits,			
	to realize the physical context and to solve complex proble	ms by oneself		
Personal Competence				
Social Competence	Students are able to prepare and perform their lab experiments in	team work as well as to present and disc	cuss the results in fron	t of audience.
Autonomy	Students are capable to acquire knowledge based on literature in	order to prepare their experiments.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation E	Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Spe	ecialisation Electrical Engineering: Comp	ulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation E	lectrical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Spe	cialisation Electrical Engineering: Comp	ulsory	



Course L0720: Electronic Devices	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Hoc Khiem Trieu
Language	DE
Cycle	WiSe
Content	 Uniformly doped semiconductor (semiconductor, crystal structure, energy band diagram, effective mass, density of state, probability of occupancy, mass action law, generation and recombination processes, generation and recombination lifetime, carrier transport mechanisms: drift current, diffusion current; equilibriums in semiconductor, semiconductor equations) pn-junction (zero applied bias, energy band diagram in thermal equilibrium, current-voltage characteristics, derivation of diode equation, consideration of space charge recombination, transient behaviour, breakdown mechanisms, various types of diodes: Zener diode, tunnel diode, backward diode, photo diode, LED, laser diode) Bipolar transistor (principle of operation, current-voltage characteristics: calculation of base, collector and emitter current, operating modes; non-ideality: actual doping profile, Early effect, breakdown, generation and recombination current and high injection; Ebers-Moll model: family of characteristics, equivalent circuit; frequency response, switching characteristics, heterojunction bipolar transistor) Unipolar devices (surface effects: surface states, work function, energy band diagram; metal-semiconductor junctions: Schottky contact, current-voltage characteristics, ohmic contact; junction field effect transistor: operating principle, current-voltage characteristics, small-signal model, breakdown characteristics; MESFET: operating principle, depletion mode and enhancement mode MESFET; MIS structure: accumulation, depletion, inversion, strong inversion, flatband voltage, oxide charges, threshold voltage, capacitance voltage characteristics; MOSFET: basic structure, principle of operation, current voltage characteristics, frequency response, subthreshold behaviour, threshold voltage, device scaling; CMOS)
Literature	S.M. Sze: Semiconductor devices, Physics and Technology, John Wiley & Sons (1985)F. Thuselt: Physik der Halbleiterbauelemente, Springer (2011) T. Thille, D. Schmitt-Landsiedel: Mikroelektronik, Halbleiterbauelemente und deren Anwendung in elektronischen Schaltungen, Springer (2004) B.L. Anderson, R.L. Anderson: Fundamentals of Semiconductor Devices, McGraw-Hill (2005) D.A. Neamen: Semiconductor Physics and Devices, McGraw-Hill (2011) M. Shur: Introduction to Electronic Devices, John Wiley & Sons (1996)
	S.M. Sze: Physics of semiconductor devices, John Wiley & Sons (2007) H. Schaumburg: Halbleiter, B.G. Teubner (1991) A. Möschwitzer: Grundlagen der Halbleiter-&Mikroelektronik, Bd1 Elektronische Halbleiterbauelemente, Carl Hanser (1992)
	HG. Unger, W. Schultz, G. Weinhausen: Elektronische Bauelemente und Netzwerke I, Physikalische Grundlagen der Halbleiterbauelemente, Vieweg (1985)

Course L0721: Electronic Devices	
Тур	Problem-based Learning
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Hoc Khiem Trieu
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0783: Measureme	nts: Methods and Data Processing			
0				
Courses				
Title		Тур	Hrs/wk	CP
EE Experimental Lab (L0781)	. (1.0770)	Laboratory Course	2	2
Measurements: Methods and Data Proces Measurements: Methods and Data Proces		Lecture Recitation Section (small)	2 1	3
	Prof. Alexander Schlaefer	necitation Section (Smail)	ı	
•				
Admission Requirements	none			
Recommended Previous	principles of mathematics			
Knowledge	principles of electrical engineering			
Educational Objectives	After taking part successfully, students have reached	he following learning recults		
Professional Competence	After taking part successionly, students have reached	are following realiting results		
Knowledge	The students are able to explain the purpose of metr	ology and the acquisition and processing of many	uromonto Thoy oss de	tail acposts of probability
Knowledge		**	•	
	theory and errors, and explain the processing of stoch	lastic signals. Students know methods to digitalize	and describe measured	signais.
Skille	The students are able to evaluate problems of metroic	nay and to apply methods for describing and proce	ssing of measurements	
Onno	The stadents are able to evaluate problems of metroic	and to apply methods for describing and proce	osing or measurements.	
Paragral Commetence				
Personal Competence				
Social Competence	The students solve problems in small groups.			
Autonomy	The students can reflect their knowledge and discuss	and evaluate their results.		
· ·	•			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 7	70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Spe	ecialisation Electrical Engineering; Compulsory		
Curricula	General Engineering Science (German program, 7 se		ctive Compulsory	
Surrodia	Computer Science: Specialisation Computer and Soft		Jopa.co.,	
	Electrical Engineering: Core qualification: Compulsor			
	General Engineering Science (English program): Spe			
	General Engineering Science (English program, 7 sei		ctive Compulsory	
	Computational Science and Engineering: Specialisati	, ,	2010 Compaisory	
	Computational Science and Engineering: Specialisati			
	Technomathematics: Specialisation III. Engineering S			
	Technomathematics: Core qualification: Elective Com			
		pa.co.,		

Course L0781: EE Experimental Lat	
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Alexander Schlaefer, Prof. Christian Schuster, Prof. Günter Ackermann, Prof. Rolf-Rainer Grigat, Prof. Arne Jacob, Prof. Herbert Werner, Dozenten
	des SD E, Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	lab experiments: digital circuits, semiconductors, micro controllers, analog circuits, AC power, electrical machines
Literature	Wird in der Lehrveranstaltung festgelegt

Course L0779: Measurements: Met	hods and Data Processing
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Alexander Schlaefer
Language	DE
Cycle	WiSe
Content	introduction, systems and errors in metrology, probability theory, measuring stochastic signals, describing measurements, acquisition of analog signals,
	applied metrology
Literature	Puente León, Kiencke: Messtechnik, Springer 2012
	Lerch: Elektrische Messtechnik, Springer 2012
	Weitere Literatur wird in der Veranstaltung bekanntgegeben.



Course L0780: Measurements: Methods and Data Processing	
Тур	Recitation Section (small)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Alexander Schlaefer
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses	
Title	Typ Hrs/wk CP
Introduction to Control Systems (L0654) Introduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2
Module Responsible	
Admission Requirements	
Recommended Previous	
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second orc
	systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.
	They can explain the role of the phase margin in analysis and synthesis of control loops
	They can explain the way a PID controller affects a control loop in terms of its frequency response
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally
Skills	
	Students can transform models of linear dynamic systems from time to frequency domain and vice versa They are simulate and access the habities of systems and central leads.
	 They can simulate and assess the behavior of systems and control loops They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules
	They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks
Barranal Campatana	
Personal Competence Social Competence	
Autonomy	
natoriomy	problems.
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.
Workload in Hours	
Credit points	6
Credit points Examination	6 Written exam
Credit points Examination Examination duration and scale	6 Written exam 120 min
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Credit points Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, F
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sy
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ene
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Fo
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Science (German program, 7 semester): Specialisation Science (German program, 7 semester): Specialisation Evolution Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Develop
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus En
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Science (German program, 7 semester): Specialisation Science (German program, 7 semester): Specialisation Evolution Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Develop
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engine
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program; Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aitcraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productive Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productive Compulsory General Engineering Science (Engilish program, 7 semester): Specialisation Mechanical Engineering, Focus Energy S
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (Engilsh program, 7 semester): Specialisation Mechanical



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Energy\ Systems:\ Compulsory\ Specialisation\ Mechanical\ Engineering,\ Mechanical\$

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems
	Linear systems, differential equations and transfer functions
	First and second order systems, poles and zeros, impulse and step response
	Stability
	Feedback systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Post logue techniques
	Root locus techniques
	 Root locus plots
	Root locus design of PID controllers
	Frequency response techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation
	Frequency response interpretation of PID control
	Time delay systems
	Root locus and frequency response of time delay systems
	Smith predictor
	Digital control
	Sampled-data systems, difference equations Turbia consoliration digital implementation of PID controllers.
	Tustin approximation, digital implementation of PID controllers
	Software tools
	Introduction to Matlab, Simulink, Control toolbox
	Computer-based exercises throughout the course
	Company according to the control of
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"
	 Werner, H., Lecture Notes "infloduction to Control Systems G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010



Course L0655: Introduction to Control Systems	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0777: Semicondu	actor Circuit Design			
Courses				
Title		Тур	Hrs/wk	СР
Semiconductor Circuit Design (L0763)		Lecture	3	4
Semiconductor Circuit Design (L0864)		Recitation Section (small)	1	2
Module Responsible	NN			
Admission Requirements	none			
Recommended Previous	Fundamentals of electrical engineering			
Knowledge	Basics of physics			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence		•		
Knowledge				
	Students are able to explain the functionality of different N	OS devices in electronic circuits.		
	 Students know the fundamental digital logic circuits and c 			
	Students have solid knowledge about memory circuits and		fications.	
	Students are able to explain how analog circuits functions			
	Students know the appropriate fields for the use of bipolar	transistors.		
				
Skills	 Students can calculate the specifications of different MOS 	devices and can define the parameters o	f electronic circuits.	
	Students are able to develop different logic circuits and ca			
	Students can use MOS devices, operational amplifiers and	d bipolar transistors for specific applicatio	ns.	
Personal Competence Social Competence	Students are able work efficiently in heterogeneous teams Students working together in small groups can solve prob			
Autonomy	Students are able to assess their level of knowledge.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation		onics: Compulsory	
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering, Foo	cus Mechatronics: Comp	ulsory
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation I	Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation !	Mechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (English program, 7 semester): Spo	ecialisation Electrical Engineering: Comp	ulsory	
	General Engineering Science (English program, 7 semester): Spe	ecialisation Mechanical Engineering, Foc	us Mechatronics: Comp	ulsory
	Mechanical Engineering: Specialisation Mechatronics: Compulso	ry		
	Mechatronics: Core qualification: Compulsory			
	Technomathematics: Core qualification: Elective Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Elec	tive Compulsory		



Course L0763: Semiconductor Circu	uit Design
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	NN
Language	DE
Cycle	SoSe
Content	 Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Scaling-down of CMOS circuits and further performance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits Electrical behavoir of BiCMOS circuits From the summer semester 2017 onwards, students have the possibility to get a bonus of 0,3 to 0,7 for improving the (passed) exam by writing a test on either the 16.05., 13.06. or the 04.07.2017. The test includes 10 questions (time limit: 20 min.).
Literature	R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 3519004674 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944 U. Tietze und Ch. Schenk, E. Gamm, Halbleiterschaltungstechnik, Springer Verlag, 14. Auflage, 2012, ISBN 3540428496 H. Göbel, Einführung in die Halbleiter-Schaltungstechnik, Berlin, Heidelberg Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208874 ISBN: 9783642208867 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 URL: http://ebooks.ciando.com/book/index.cfm/bok_id/319955 URL: http://www.ciando.com/img/bo



Typ R	Recitation Section (small)
Hrs/wk 1	1
CP 2	2
Workload in Hours In	Independent Study Time 46, Study Time in Lecture 14
Lecturer N	NN
Language D	DE
Cycle S	SoSe
Content Literature R H K U H 9	Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Calling-down of CMOS circuits and further performance improvements Coperational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits B. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 3519004674 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944 U. Tietze und Ch. Schenk, E. Gamm, Halbleiter-Schaltungstechnik, Springer Verlag, 14. Auflage, 2012, ISBN 3540428496 H. Göbel, Einführung in die Halbleiter-Schaltungstechnik, Berlin, Heidelberg Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208874 ISBN: 9783642208867 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 URL: http://www.ciando.com/book/index.cfm/bok_id/319955 URL: http://www.ciando.com/book/index.cfm/bok_id/319955 URL: http://www.ciando.com/fook/index.cfm/bok_id/319955



lodule M0829: Foundation	ns of Management			
ourses				
tle		Тур	Hrs/wk	СР
troduction to Management (L0880)		Lecture	3	3
oject Entrepreneurship (L0882)		Problem-based Learning	2	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning r	esults		
Professional Competence				
Knowledge	After taking this module, students know the important basics of many different Marketing and Innovation, and also to Investment and Controlling. In particul		anagement, from Plani	ning and Organisation
	explain the differences between Economics and Management and the field of Management	e sub-disciplines in Manager	ment and to name impo	ortant definitions from
	field of Management	name the most important sen	acts of antropropurial	arajaata
	explain the most important aspects of and goals in Management and describe and explain basic business functions as production, procu			
	ressource management, information management, innovation management		Cham management,	organization and nun
	explain the relevance of planning and decision making in Busines		ultiple objectives and	uncertainty, and expl
	some basic methods from mathematical Finance	s, cop. in oldanono andor ini	and objectives and	arroomarriy, arra oxpi
	state basics from accounting and costing and selected controlling me	thods.		
Skills	Students are able to analyse business units with respect to different	criteria (organization, obje	ectives, strategies etc	.) and to carry out
	Entrepreneurship project in a team. In particular, they are able to			
	analyse Management goals and structure them appropriately			
	analyse organisational and staff structures of companies			
	apply methods for decision making under multiple objectives, under under multiple objectives.	uncertainty and under risk		
	analyse production and procurement systems and Business informat	ion systems		
	analyse and apply basic methods of marketing			
	select and apply basic methods from mathematical finance to predefi	ned problems		
	apply basic methods from accounting, costing and controlling to pred	efined problems		
Personal Competence				
Social Competence				
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepreneurship proj	ect and write a coherent repor	rt on the project	
	to communicate appropriately and			
	to cooperate respectfully with their fellow students.			
Autonomy	Students are able to			
	work in a team and to organize the team themselves			
	to write a report on their project.			
Wester de Herre	Indicated On d. Toronto On d. Toronto Indicate To			
Workload in Hours				
Credit points				
Examination				
Examination duration and scale	90 minutes			
Assignment for the Following		0 0 1 ,		
Curricula		' '		
	General Engineering Science (German program): Specialisation Process En			
	General Engineering Science (German program): Specialisation Bioprocess			
	General Engineering Science (German program): Specialisation Energy and	-		
	General Engineering Science (German program): Specialisation Civil- and E		ompulsory	
	General Engineering Science (German program): Specialisation Mechanica			
	General Engineering Science (German program): Specialisation Biomedical			
	General Engineering Science (German program): Specialisation Naval Arch			
	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Specialisation	·	•	
	General Engineering Science (German program, 7 semester): Specialisation		•	
	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Specialisation			.,
	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Specialisation	-		
	General Engineering Science (German program, 7 semester): Specialisation	-	•	
	General Engineering Science (German program, 7 semester): Specialisa	ation Mechanical Engineerin	ıg, ⊢ocus Materials in	∟ngineering Sciend
	Compulsory			
	General Engineering Science (German program, 7 semester): Specialisa	tion Mechanical Engineering	g, Focus Theoretical N	Mechanical Engineeri



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

ompulsory

 $General\ Engineering\ Science\ (German\ program, 7\ semester): Specialisation\ Mechanical\ Engineering, Focus\ Energy\ Systems: Compulsory$

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory

Electrical Engineering: Core qualification: Compulsory
Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

 $\label{thm:control_general} \textbf{General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory and Compulso$

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program); Specialisation Process Engineering; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 $\label{thm:mechanical engineering: Core qualification: Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Тур	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga
Lecturer	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	WIGHTOOL
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management
	Important definitions from Management,
	 Developing Objectives for Business, and their relation to important Business functions
	Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management
	Marketing and Sales
	Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management
	Definitions as information, information systems, aspects of data security and strategic information systems
	 Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing
	 different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures
	basics of human ressource management
	Introduction to Business Planning and the steps of a planning process
	Decision Analysis: Elements of decision problems and methods for solving decision problems
	Selected Planning Tasks, e.g. Investment and Financial Decisions
	Introduction to Accounting: Accounting, Balance-Sheets, Costing
	Relevance of Controlling and selected Controlling methods
	Important aspects of Entrepreneurship projects
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.
	Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Course L0882: Project Entrepreneurship		
Тур	Problem-based Learning	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke	
Language	DE	
Cycle	WiSe/SoSe	
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,	
	using their knowledge from the corresponding lecture.	
	Project work is carried out in teams with the support of a mentor.	
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.	



Module M0734: Electrical E	ngineering Project Laboratory
Courses	
Title	Typ Hrs/wk CP
Electrical Engineering Project Laboratory (Laboratory Course 5 6
Module Responsible	Prof. Christian Becker
Admission Requirements	None
Recommended Previous	Electrical Engineering I, Electrical Engineering II
Knowledge	
Educational Objectives	After taking and a recentilly students have received the following leaving receives
	After taking part successfully, students have reached the following learning results
Professional Competence Knowledge	Students are able to give a summary of the technical details of projects in the area of electrical engineering and illustrate respective relationships. They
Knowledge	are capable of describing and communicating relevant problems and questions using appropriate technical language. They can explain the typica
	process of solving practical problems and present related results.
	process of contrag processes and process related to content.
Skills	The students can transfer their fundamental knowledge on electrical engineering to the process of solving practical problems. They identify and
	overcome typical problems during the realization of projects in the context of electrical engineering. Students are able to develop, compare, and choose
	conceptual solutions for non-standardized problems.
Personal Competence	
Social Competence	Students are able to cooperate in small, mixed-subject groups in order to independently derive solutions to given problems in the context of electrica
	engineering. They are able to effectively present and explain their results alone or in groups in front of a qualified audience. Students have the ability to
	develop alternative approaches to an electrical engineering problem independently or in groups and discuss advantages as well as drawbacks.
Autonomy	Students are capable of independently solving electrical engineering problems using provided literature. They are able to fill gaps in as well as exten
	their knowledge using the literature and other sources provided by the supervisor. Furthermore, they can meaningfully extend given problems and
	pragmatically solve them by means of corresponding solutions and concepts.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Examination	Project
Examination duration and scale	based on task + presentation
Assignment for the Following	General Engineering Science (German program): Specialisation Electrical Engineering: Compulsory
Curricula	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
	Electrical Engineering: Core qualification: Compulsory
	General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory Technomathematics: Core qualification: Elective Compulsory
	Technomationation over qualification. Elective Computativy

Course L0640: Electrical Engineering Project Laboratory		
Тур	Laboratory Course	
Hrs/wk	· ·	
CP	6	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70	
Lecturer	Prof. Christian Becker, Dozenten des SD E	
Language	DE	
Cycle	SoSe	
Content	Topics and projects cover the entire field of applications of electrical engineering. Typically, the students will prototype functional units and self-container	
	systems, such as radar devices, networks of sensors, amateur radio transceiver, discrete computers, or atomic force microscopes. Different projects are	
	devised on a yearly basis.	
Literature	Alle zur Durchführung der Projekte sinnvollen Quellen (Skripte, Fachbücher, Manuals, Datenblätter, Internetseiten). / All sources that are useful for	
Literature	completion of the projects (lecture notes, textbooks, manuals, data sheets, internet pages).	
	completion of the projects (fectible notes, featibooks, manuals, data sneets, internet pages).	



Specialization Energy and Environmental Engineering

One of the main challenges in modern society is the reliable, environmentally benign and sustainable supply of energy. An efficient energy supply is moreover essential to secure the economic future of the country.

The exponential increase in world population, the raised living standards and the continuously increasing hunger for feedstocks, acreage and energy make imperative the sustainable handling of natural resources. This includes the reduction of emissions and the minimisation of environmental impact. An example with growing significance is the control of the CO₂ emissions that are responsible for the greenhouse effect. For this, possibilities are sought that bring energy savings or involve increased use of renewable energy sources. In a continued utilisation of fossil fuels the reduction of CO₂ emissions is pursued by increasing efficiency and also through separation and underground storage of the CO₂ emitted. The latter approaches make a close cooperation between Energy Engineering and Environmental Engineering unavoidable.

The study specialisation in Energy and Environmental Engineering of the degree General Engineering Science responds to two developments: on the one hand the increasing significance of environmental protection through CO₂ separation in large power stations and, on the other, the growing supply of electricity from regenerative energy sources. Both these key developments in electricity generation are taken into consideration in designing the degree course. Not only for the CO₂ separation technologies but also for other environmental protection purposes, as for example air pollution protection, key qualifications in Chemistry play an important role. Conventional and renewable electricity generation technologies are covered in the degree more detailed but still under a generalist viewpoint.

The study specialisation in Energy and Environmental Engineering of the degree General Engineering Science conveys a wide and well-founded multidisciplinary fundamental knowledge in the disciplines of Energy Engineering and of Environmental Engineering. Extending a well-grounded understanding in the core qualifications over basic engineering methods (mathematics, mechanics, thermodynamics, fluid mechanics, physics, chemistry, electrical engineering, informatics and engineering construction) additional skills are conveyed in energy technology, environmental assessment, environmental technology, materials science and particle technology, along with non-technical subjects. These provide necessary qualifications for elaborating the supporting processes during system development. At the skills level the Bachelor degree prepares the student for a Master study or even a PhD research too, so that after graduation also professional qualifications suitable for a potential future research career are gained.

Module M0730: Computer B	Engineering		
Courses			
Title	Typ Hrs/wk CP		
Computer Engineering (L0321)	Lecture 3 4		
Computer Engineering (L0324)	Recitation Section (small) 1 2		
Module Responsible	Prof. Heiko Falk		
Admission Requirements	None		
Recommended Previous	Basic knowledge in electrical engineering		
Knowledge	The successful completion of the labs will be honored during the evaluation of the module's examination according to the following rules:		
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the successful labs, such that the		
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	This module deals with the foundations of the functionality of computing systems. It covers the layers from the assembly-level programming down to		
	gates. The module includes the following topics:		
	Introduction Contribution		
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks		
	Sequential logic: Flip-flops, automata, systematic hardware design Tables is all foundations.		
	Technological foundations Computer or ith material laterary addition, subtraction, multiplication, and division.		
	Computer arithmetic: Integer addition, subtraction, multiplication and division Region of computer arithmetic: Programming models MIPS girale guels are hitself up nine lines.		
	 Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining Memories: Memory hierarchies, SRAM, DRAM, caches 		
	 Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses 		
	• Inputoutput. #O from the perspective of the GPO, principles of passing data, point-to-point conflections, busses		
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the physical composition of		
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a collection of few and simple		
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing systems - from gates and circuits		
	up to complete processors.		
	After successful completion of the module, the students are able to judge the interdependencies between a physical computer system and the software		
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-centric abstraction layers from		
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels have on an entire system's		
	performance and to propose feasible options.		
Personal Competence			
Social Competence	Students are able to solve similar problems alone or in a group and to present the results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Examination	Written exam		
Examination duration and scale	90 minutes, contents of course and labs		
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory		



General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory

 $General\ Engineering\ Science\ (German\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Compulsory\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Mechanical\ Engineering,\ Focus\ Mechanical\ Engineering,\ Mec$

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences
Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computer Science: Core qualification: Compulsory

Electrical Engineering: Core qualification: Compulsory

General Engineering Science (English program): Core qualification: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester); Specialisation Naval Architecture; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester); Specialisation Process Engineering; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences
Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsorv

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Energy\ Systems:\ Compulsory\ Comp$

Computational Science and Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation II. Informatics: Elective Compulsory

Course L0321: Computer Engineering		
Тур	ecture	
Hrs/wk		
CP	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Heiko Falk	
Language	JE	
Cycle	WiSe	
Content	Introduction Combinational Logic Sequential Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output	
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005. 	

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0933: Fundamen	tals of Materials Science			
	- Indicate Science			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Materials Science I (L1085)		Lecture	2	2
rundamentals of Materials Science II (Adv Physical and Chemical Basics of Materials	vanced Ceramic Materials, Polymers and Composites) (L0506)	Lecture Lecture	2	2
	Prof. Jörg Weißmüller	Lecture	2	2
-	*			
Admission Requirements Recommended Previous	None			
Knowledge	Highschool-level physics, chemistry und mathematics			
Kilowiedge				
Educational Objectives	After taking part cureoccefully, ctudents have reached the following	Loarning recults		
	After taking part successfully, students have reached the following	rearring results		
Professional Competence	The students have acquired a fundamental knowledge on m	atala agramica and nalumara a	and can describe this know	dadaa aamarahansiy
Knowledge	The students have acquired a fundamental knowledge on metals, ceramics and polymers and can describe this knowledge comprehensive Fundamental knowledge here means specifically the issues of atomic structure, microstructure, phase diagrams, phase transformations, corrosion a			
	mechanical properties. The students know about the key aspec			
	characterizing specific properties. They are able to trace materials			
		, , , , , , , , , , , , , , , , , , , ,	.9 p.,,	
Skills	The students are able to trace materials phenomena back to the	underlying physical and chemica	I laws of nature. Materials p	henomena here refers
	mechanical properties such as strength, ductility, and stiffness, cl			
	solidification, precipitation, or melting. The students can explain		conditions and the materials	microstructure, and t
	can account for the impact of microstructure on the material's beh	avior.		
Personal Competence				
Social Competence	-			
Autonomy	-			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program): Specialisation	Mechanical Engineering: Compuls	sory	
	General Engineering Science (German program): Specialisation		ory	
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp	ecialisation Biomedical Engineerir	ng: Compulsory	
		*		
	General Engineering Science (German program, 7 semester): Sp	ecialisation Naval Architecture: Co		
	General Engineering Science (German program, 7 semester): Sp	ecialisation Naval Architecture: Co ecialisation Energy and Enviromen		у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Comp	ecialisation Naval Architecture: Co ecialisation Energy and Enviromen oulsory	ntal Engineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Comp General Engineering Science (English program): Specialisation E	ecialisation Naval Architecture: Co ecialisation Energy and Enviromen oulsory Energy and Enviromental Engineer	ntal Engineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Comp General Engineering Science (English program): Specialisation B General Engineering Science (English program): Specialisation N	ecialisation Naval Architecture: Co ecialisation Energy and Enviromen bulsory Energy and Enviromental Engineer Mechanical Engineering: Compulsa	ntal Engineering: Compulsor ring: Compulsory ory	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Comp General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation M General Engineering Science (English program): Specialisation E	ecialisation Naval Architecture: Co ecialisation Energy and Enviromen bulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulso	ntal Engineering: Compulsor ring: Compulsory ory	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Comp General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation N	ecialisation Naval Architecture: Co ecialisation Energy and Enviromen bulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulsory	ntal Engineering: Compulsor ring: Compulsory ory	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Comp General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation M General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation M General Engineering Science (English program, 7 semester): Specialisation M	ecialisation Naval Architecture: Co ecialisation Energy and Enviromen bulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulsory ecialisation Mechanical Engineering	ntal Engineering: Compulsor ring: Compulsory ory ory ng: Compulsory	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Comp General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation M General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation M General Engineering Science (English program, 7 semester): Specialisation M General Engineering Science (English program, 7 semester): Specialisation M	ecialisation Naval Architecture: Co ecialisation Energy and Enviromen bulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulsory ecialisation Mechanical Engineerin ecialisation Biomedical Engineerin	ntal Engineering: Compulsor ring: Compulsory ory ng: Compulsory g: Compulsory	у
	General Engineering Science (German program, 7 semester): Spe Energy and Environmental Engineering: Core qualification: Comp General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation E General Engineering Science (English program, 7 semester): Specialisation E General Engineering Science (English program, 7 semester): Specialisation E General Engineering Science (English program, 7 semester): Specialisation Engineering Science (English program)	ecialisation Naval Architecture: Co ecialisation Energy and Enviromen bulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulso Javal Architecture: Compulsory ecialisation Mechanical Engineerin ecialisation Biomedical Engineerin ecialisation Naval Architecture: Con	ntal Engineering: Compulsor ring: Compulsory ory ng: Compulsory g: Compulsory mpulsory mpulsory	
	General Engineering Science (German program, 7 semester): Spenergy and Environmental Engineering: Core qualification: Companeral Engineering Science (English program): Specialisation Egeneral Engineering Science (English program): Specialisation Magneral Engineering Science (English program): Specialisation Egeneral Engineering Science (English program): Specialisation Magneral Engineering Science (English program, 7 semester): Specialisation Egeneral Engineering Science (English program, 7 semester): Specialisation Engineering Engine	ecialisation Naval Architecture: Co ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulsory Javal Architecture: Compulsory ecialisation Mechanical Engineerin ecialisation Biomedical Engineerin ecialisation Naval Architecture: Col ecialisation Energy and Enviromen	ntal Engineering: Compulsor ring: Compulsory ory ng: Compulsory g: Compulsory mpulsory mpulsory	
	General Engineering Science (German program, 7 semester): Spenergy and Environmental Engineering: Core qualification: Companeral Engineering Science (English program): Specialisation Egeneral Engineering Science (English program): Specialisation Meneral Engineering Science (English program): Specialisation Meneral Engineering Science (English program): Specialisation Meneral Engineering Science (English program, 7 semester): Specialisation Meneral Engineering Science (English program, 7 semester): Specialisation Engineering Science (English program, 7 semester): Specialisation Engineering Science (English program, 7 semester): Specialisation Engineering Science: Electives and Mobility: Specialisation Engineering Science: Electives	ecialisation Naval Architecture: Co ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulsory Javal Architecture: Compulsory ecialisation Mechanical Engineerin ecialisation Biomedical Engineerin ecialisation Naval Architecture: Col ecialisation Energy and Enviromen	ntal Engineering: Compulsor ring: Compulsory ory ng: Compulsory g: Compulsory mpulsory mpulsory	
	General Engineering Science (German program, 7 semester): Spenergy and Environmental Engineering: Core qualification: Companeral Engineering Science (English program): Specialisation Egeneral Engineering Science (English program): Specialisation Meneral Engineering Science (English program): Specialisation Meneral Engineering Science (English program): Specialisation Meneral Engineering Science (English program, 7 semester): Specialisation Meneral Engineering Science (English program, 7 semester): Specialisation Engineering Science (English program, 7 semester): Specialisation Engineering Science (English program, 7 semester): Specialisation Engineering Science: Electi Mechanical Engineering: Core qualification: Compulsory	ecialisation Naval Architecture: Co ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulsory Javal Architecture: Compulsory ecialisation Mechanical Engineerin ecialisation Biomedical Engineerin ecialisation Naval Architecture: Col ecialisation Energy and Enviromen	ntal Engineering: Compulsor ring: Compulsory ory ng: Compulsory g: Compulsory mpulsory mpulsory	
	General Engineering Science (German program, 7 semester): Spenergy and Environmental Engineering: Core qualification: Companeral Engineering Science (English program): Specialisation Egeneral Engineering Science (English program): Specialisation Meneral Engineering Science (English program): Specialisation Meneral Engineering Science (English program): Specialisation Meneral Engineering Science (English program, 7 semester): Specialisation Meneral Engineering Science (English program, 7 semester): Specialisation Engineering Science (English program, 7 semester): Specialisation Engineering Science (English program, 7 semester): Specialisation Engineering Science: Electives and Mobility: Specialisation Engineering Science: Electives	ecialisation Naval Architecture: Co ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulsory Javal Architecture: Compulsory ecialisation Mechanical Engineerin ecialisation Biomedical Engineerin ecialisation Naval Architecture: Col ecialisation Energy and Enviromen	ntal Engineering: Compulsor ring: Compulsory ory ng: Compulsory g: Compulsory mpulsory mpulsory	

Course L1085: Fundamentals of Materials Science I		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Jörg Weißmüller	
Language	DE	
Cycle	WiSe	
Content		
Literature	Vorlesungsskript	
	W.D. Callister: Materials Science and Engineering - An Introduction. 5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7	



Course L0506: Fundamentals of Materials Science II (Advanced Ceramic Materials, Polymers and Composites)		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Bodo Fiedler, Prof. Gerold Schneider	
Language	DE	
Cycle	SoSe	
Content	Chemische Bindungen und Aufbau von Festkörpern; Kristallaufbau; Werkstoffprüfung; Schweißbarkeit; Herstellung von Keramiken; Aufbau und	
	Eigenschaften der Keramik; Herstellung, Aufbau und Eigenschaften von Gläsern; Polymerwerkstoffe, Makromolekularer Aufbau; Struktur und	
	Eigenschaften der Polymere; Polymerverarbeitung; Verbundwerkstoffe	
Literature	Vorlesungsskript	
	W.D. Callister: Materials Science and Engineering -An Introduction-5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7	

Course L1095: Physical and Chemic	cal Basics of Materials Science
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Müller
Language	DE
Cycle	WiSe
Content	Motivation: "Atoms in Mechanical Engineering?" Basics: Force and Energy The electromagnetic Interaction "Detour": Mathematics (complex e-funktion etc.) The atom: Bohr's model of the atom Chemical bounds The multi part problem: Solutions and strategies Descriptions of using statistical thermodynamics Elastic theory of atoms Consequences of atomar properties on makroskopic Properties: Discussion of examples (metals, semiconductors, hybrid systems)
Literature	Für den Elektromagnetismus: • Bergmann-Schäfer: "Lehrbuch der Experimentalphysik", Band 2: "Elektromagnetismus", de Gruyter Für die Atomphysik: • Haken, Wolf: "Atom- und Quantenphysik", Springer Für die Materialphysik und Elastizität: • Hornbogen, Warlimont: "Metallkunde", Springer



Module M0598: Mechanical	Engineering: Design			
Courses				
		Typ	Unobul	CD
Title		Typ Lecture	Hrs/wk	CP
Embodiment Design and 3D-CAD (L0268) Mechanical Design Project I (L0695)		Practical Course	2	2
Mechanical Design Project II (L0592)		Practical Course	3	2
Team Project Design Methodology (L0267	7)	Problem-based Learning	2	1
Module Responsible	Prof. Dieter Krause	Trobotii Sacod Esarring		•
Admission Requirements	None			
Recommended Previous				
Knowledge	 Fundamentals of Mechanical Engineering Design 			
Kilowicuge	Mechanics			
	 Fundamentals of Materials Science 			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the followi	ng learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
G				
	explain design guidelines for machinery parts e.g. consi	dering load situation, materials and manufa	acturing requirements	,
	 describe basics of 3D CAD, 			
	 explain basics methods of engineering designing. 			
Skills	After passing the module, students are able to:			
	 independently create sketches, technical drawings and 	documentations e.g. using 3D CAD.		
	design components based on design guidelines autono			
	dimension (calculate) used components,	modely,		
	 use methods to design and solve engineering design ta 	cks systemtically and solution oriented		
	apply creativity techniques in teams.	sks systamically and solution-onemed,		
	apply creativity techniques in teams.			
Personal Competence				
Social Competence	After passing the module, students are able to:			
	 develop and evaluate solutions in groups including maken 	ing and documenting decisions		
	moderate the use of scientific methods,	ing and documenting decisions,		
	 present and discuss solutions and technical drawings w 	ithin groups		
	 reflect the own results in the work groups of the course. 	aimi groupo,		
	is now, the control of the first section.			
Autonomy	Students are able			
	to estimate their level of knowledge using activating me	ethods within the lectures (e.g. with clickers),	
	 To solve engineering design tasks systematically. 			
Workload in Hours	Independent Study Time 40, Study Time in Lecture 140			
Credit points Examination	6 Written exam			
Examination duration and scale	180			
Assignment for the Following	General Engineering Science (German program): Specialisatio	n Energy and Environmental Engineering: C	omnulsory	
Curricula	General Engineering Science (German program): Specialisatio		ompaisory	
Carriodia	General Engineering Science (German program): Specialisatio			
	General Engineering Science (German program, 7 semester): S	0 0 1	mpulsory	
	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester): S			v
	Energy and Environmental Engineering: Core qualification: Cor		gmaamig. Oompulsor	,
	General Engineering Science (English program): Specialisation	• •	nmnulson/	
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation		Jiiipulsury	
	, , , , , ,			
	General Engineering Science (English program): Specialisation		mpulcon.	
	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S	pecialisation Energy and Enviromental En	gineering: Compulsor	у
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			



Course L0268: Embodiment Design	and 3D-CAD		
Тур	Lecture		
Hrs/wk	?		
СР			
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28		
Lecturer	Prof. Dieter Krause		
Language	DE		
Cycle	WiSe		
Content	Basics of 3D CAD technology Practical course to apply a 3D CAD system Introduction to the system Sketching and creation of components Creation of assemblies Deriving technical drawings		
Literature	 CAx für Ingenieure eine praxisbezogene Einführung; Vajna, S., Weber, C., Bley, H., Zeman, K.; Springer-Verlag, aktuelle Auflage. Handbuch Konstruktion; Rieg, F., Steinhilper, R.; Hanser; aktuelle Auflage. Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Technisches Zeichnen: Grundlagen, Normen, Beispiele, Darstellende Geometrie, Hoischen, H; Hesser, W; Cornelsen, aktuelle Auflage. Maschinenelemente, Band I-Ill; Niemann, G., Springer-Verlag, aktuelle Auflage. Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage. 		

Course L0695: Mechanical Design Project I					
Тур	Practical Course				
Hrs/wk	3				
CP	2				
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42				
Lecturer	Prof. Thorsten Schüppstuhl				
Language	DE				
Cycle	WiSe				
Content	Create a technical documentation of an existing mechanical model Consolidation of the following aspects of technical drawings: Presentation of technical objects and standardized parts (bearings, seals, shaft-hub joints, detachable connections, springs, axes and shafts) Sectional views Dimensioning Tolerances and surface specifications Creating a tally sheet				
Literature	 Hoischen, H.; Hesser, W.: Technisches Zeichnen. Grundlagen, Normen, Beispiele, darstellende Geometrie, 33. Auflage. Berlin 2011. Labisch, S.; Weber, C.: Technisches Zeichnen. Selbstständig lernen und effektiv üben, 4. Auflage. Wiesbaden 2008. Fischer, U.: Tabellenbuch Metall, 43. Auflage. Haan-Gruiten 2005. 				



Course L0592: Mechanical Design Project II				
Тур	Practical Course			
Hrs/wk	3			
CP	2			
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42			
Lecturer	Prof. Wolfgang Hintze			
Language	DE			
Cycle	SoSe			
Content	Generation of sketches for functions and sub-functions Approximately calculation of shafts Dimension of bearings, screw connections and weld Generation of engineering drawings (assembly drawings, manufacturing drawing)			
Literature	Dubbel, Taschenbuch für Maschinenbau, Beitz, W., Küttner, KH, Springer-Verlag. Maschinenelemente, Band I - III, Niemann, G., Springer-Verlag. Maschinen- und Konstruktionselemente, Steinhilper, W., Röper, R., Springer-Verlag. Einführung in die DIN-Normen, Klein, M., Teubner-Verlag. Konstruktionslehre, Pahl, G., Beitz, W., Springer-Verlag.			

Course L0267: Team Project Design Methodology					
Тур	Problem-based Learning				
Hrs/wk	2				
CP	1				
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28				
Lecturer	Prof. Dieter Krause				
Language	DE				
Cycle	SoSe				
Content	Introduction to engineering designing methodology Team Project Design Methodology Creating requirement lists Problem formulation Creating functional structures Finding solutions Evaluation of the found concepts Documentation of the taken methodological steps and the concepts using presentation slides				
Literature	 Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage. Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage. Sowie weitere Bücher zu speziellen Themen 				



Module M0536: Fundament	als of Fluid Mechanics					
Courses						
Title		Тур	Hrs/wk	CP		
Fundamentals of Fluid Mechanics (L0091)		Lecture	2	4		
Fluid Mechanics for Process Engineering		Recitation Section (large)	2	2		
Module Responsible	Prof. Michael Schlüter					
Admission Requirements	None					
Recommended Previous	Mathematics I+II+III					
Knowledge	Technical Mechanics I+II					
	Technical Thermodynamics I+II					
	Working with force balances					
	 Simplification and solving of partial differential equ 	ations				
	Integration					
Educational Objectives	After taking part successfully, students have reached the fi	ollowing learning results				
Professional Competence						
Knowledge	Students are able to:					
-	a cyclain the difference between different types of fly					
	 explain the difference between different types of flow give an overview for different applications of the Reynolds Transport-Theorem in process engineering 					
	give an overview for different applications of the neyholds transport Theorem in process engineering explain simplifications of the Continuity- and Navier-Stokes-Equation by using physical boundary conditions					
Skills	The students are able to					
	 describe and model incompressible flows mathem 	atically				
	reduce the governing equations of fluid mechanics by simplifications to archive quantitative solutions e.g. by integration					
	notice the dependency between theory and technical applications					
	 use the learned basics for fluid dynamical applicat 	ions in fields of process engineering				
Personal Competence						
Social Competence	The students					
	are capable to gather information from subject related, professional publications and relate that information to the context of the lecture and					
	 able to work together on subject related tasks in sr 					
	exercises)					
	are able to work out solutions for exercises by there	nselves, to discuss the solutions orally and to pr	esent the results.			
Autonomy	y The students are able to					
,						
	search further literature for each topic and to expan work on their evergines by their even and to evalue					
	 work on their exercises by their own and to evalua 	te their actual knowledge with the leedback.				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56					
Credit points	6					
Examination	Written exam					
Examination duration and scale	3 hours					
Assignment for the Following	General Engineering Science (German program): Special					
Curricula	General Engineering Science (German program): Special		Sampulaan.			
	General Engineering Science (German program): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory					
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory					
	General Engineering Science (German program, 7 semes			ry		
	Bioprocess Engineering: Core qualification: Compulsory					
	Energy and Environmental Engineering: Core qualification	n: Compulsory				
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory					
	General Engineering Science (English program): Speciali	0,	ompulsory			
	General Engineering Science (English program): Speciali	0 0 1 ,	lleory			
	General Engineering Science (English program, 7 semes: General Engineering Science (English program, 7 semes:					
	General Engineering Science (English program, 7 semes			v		
	Technomathematics: Specialisation III. Engineering Scien	, ,	_ 5	-		
	Process Engineering: Core qualification: Compulsory					



Course L0091: Fundamentals of Flui	id Mechanics
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Michael Schlüter
Language	DE
Cycle	SoSe
Content	 fluid properties hydrostatic overall balances - theory of streamline overall balances- conservation equations differential balances - Navier Stokes equations irrotational flows - Potenzialströmungen flow around bodies - theory of physical similarity turbulent flows compressible flows
Literature	 Crowe, C. T.: Engineering fluid mechanics. Wiley, New York, 2009. Durst, F.: Strömungsmechanik: Einführung in die Theorie der Strömungen von Fluiden. Springer-Verlag, Berlin, Heidelberg, 2006. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994 Herwig, H.: Strömungsmechanik: Eine Einführung in die Physik und die mathematische Modellierung von Strömungen. Springer Verlag, Berlin, Heidelberg, New York, 2006 Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008 Kuhlmann, H.C.: Strömungsmechanik. München, Pearson Studium, 2007 Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2009 Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007 Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berlin, Heidelberg, 2008 Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006 van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882. White, F.: Fluid Mechanics, Mcgraw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011

Course L0092: Fluid Mechanics for Process Engineering		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Michael Schlüter	
Language	DE	
Cycle	SoSe	
Content	In the exercise-lecture the topics from the main lecture are discussed intensively and transferred into application. For that, the students receive example tasks for download. The students solve these problems based on the lecture material either independently or in small groups. The solution is discussed with the students under scientific supervision and parts of the solutions are presented on the chalk board. At the end of each exercise-lecture, the correct solution is presented on the chalk board. Parallel to the exercise-lecture tutorials are held where the student solve exam questions under a set time-frame in small groups and discuss the solutions afterwards.	
Literature	 Crowe, C. T.: Engineering fluid mechanics. Wiley, New York, 2009. Durst, F.: Strömungsmechanik: Einführung in die Theorie der Strömungen von Fluiden. Springer-Verlag, Berlin, Heidelberg, 2006. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994. Herwig, H.: Strömungsmechanik: Eine Einführung in die Physik und die mathematische Modellierung von Strömungen. Springer Verlag, Berlin, Heidelberg, New York, 2006. Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008. Kuhlmann, H.C.: Strömungsmechanik: München, Pearson Studium, 2007. Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2009. Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007. Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berlin, Heidelberg, 2008. Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006. van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882. White, F.: Fluid Mechanics, Mcgraw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011. 	



Module M0610: Electrical M	lachines			
0				
Courses				
Title		Тур	Hrs/wk	CP
Electrical Machines (L0293)		Lecture	3	4
Electrical Machines (L0294)	T	Recitation Section (large)	2	2
Module Responsible	NN			
Admission Requirements	none			
Recommended Previous	Basics of mathematics, in particular complexe numbers, integrals, differentials			
Knowledge	Basics of electrical engineering and mechanical engineering			
Educational Objectives	After taking part successfully, students have reached the following I	earning results		
Professional Competence				
Knowledge	Students can to draw and explain the basic principles of electric ar	d magnetic fields.		
	They can describe the function of the standard types of electric	machines and present the correspon	nding equations and o	haracteristic curves For
	typically used drives they can explain the major parameters of the	·		
	, , , , , , , , , , , , , , , , , , , ,			g
Skills	Students arw able to calculate two-dimensional electric and magne	etic fields in particular ferromagnetic c	ircuits with air gap. For	this they apply the usual
	methods of the design auf electric machines.			
	They can calulate the operational performance of electric machines	from their given characteristic data a	nd selected quantities a	nd characteristic curves
	They apply the usual equivalent circuits and graphical methods.	one and a given enalacionese data a	ia corocioa quaritito a	
	, app.,			
Personal Competence				
Social Competence				
•				
Autonomy	Students are able independently to calculate electric and magnatic fields for applications. They are able to analyse independently the operational			
	performance of electric machines from the charactersitic data and theycan calculate thereof selected quantities and characteristic curves.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisation El	nergy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specialisation M	echanical Engineering: Elective Comp	oulsory	
	General Engineering Science (German program, 7 semester): Spec		•	/
	General Engineering Science (German program, 7 semester): Spec	**		
	Electrical Engineering: Core qualification: Elective Compulsory	5 9	. ,	
	Energy and Environmental Engineering: Core qualification: Compu	Isory		
	General Engineering Science (English program): Specialisation En		Compulsory	
	General Engineering Science (English program): Specialisation Me			
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): Spec			
	Computational Science and Engineering: Specialisation Engineeri		. ,	
	Logistics and Mobility: Specialisation Engineering Science: Elective			
	Mechanical Engineering: Core qualification: Elective Compulsory	•		
	Mechatronics: Core qualification: Compulsory			



Course L0293: Electrical Machines	
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	NN
Language	DE
Cycle	SoSe
Content	Electric field: Coulomb's law, flux (field) line, work, potential, capacitor, energy, force
	Magnetic field: force, flux line, Ampere's law, field at bounderies, flux, magnetic circuit, hysteresis, induction, self-induction, mutual inductance, transformer DC-Machines: Construction and layout, torque generation mechanismen, torque vs speed characteristics, commutation,
	Asynchronous Machines. Magnetic field, construction and layout, equivalent single line diagram, complex stator current diagram (Heylands'diagram), torque vs. speed characteristics, rotor layout (Squirrelcage vs. sliprings),
	Synchronous machines, construction and layout, equivalent single line diagrams, no-load and short-cuircuit characteristics, vector diagrams, motor and generator operation
	drives with variable speed, inverter fed operation, special drives, step motors,
Literature	Hermann Linse, Roland Fischer: "Elektrotechnik für Maschinenbauer", Vieweg-Verlag; Signatur der Bibliothek der TUHH: ETB 313
	Ralf Kories, Heinz Schmitt-Walter: "Taschenbuch der Elektrotechnik"; Verlag Harri Deutsch; Signatur der Bibliothek der TUHH: ETB 122 "Grundlagen der Elektrotechnik" - anderer Autoren Fachbücher "Elektrische Maschinen"

Course L0294: Electrical Machines		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	NN	
Language	DE	
Cycle	SoSe	
Content	Exercises to the application of electric and magnetic fields.	
	Excercises to the operational performance of eletric machines.	
Literature	Hermann Linse, Roland Fischer: "Elektrotechnik für Maschinenbauer", Vieweg-Verlag; Signatur der Bibliothek der TUHH: ETB 313	
	Ralf Kories, Heinz Schmitt-Walter: "Taschenbuch der Elektrotechnik"; Verlag Harri Deutsch; Signatur der Bibliothek der TUHH: ETB 122	
	"Grundlagen der Elektrotechnik" - anderer Autoren	
	Fachbücher "Elektrische Maschinen"	



Module M0618: Renewables	s and Energy Systems			
Courses				
Title		Тур	Hrs/wk	CP
Power Industry (L0316)		Lecture	1	1
Energy Systems and Energy Industry (L03	315)	Lecture	2	2
Renewable Energy (L0313)		Lecture	2	2
Renewable Energy (L1434)		Recitation Section (small)	1	1
Module Responsible	Prof. Martin Kaltschmitt			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	wing learning results		
Professional Competence				
Knowledge	With completion of this module, the students can provide a	an overview of characteristics of energy sys	ems and their econd	mic efficiency. They can
	explain the issues occurring in this context. Furthermore, the	y can explain details of power generation, po	wer distribution and	power trading wih regard
	to subject-related contexts. The students can explain these a	aspects, which are applicable to many energy	y systems in general,	especially for renewable
	energy systems and critical discuss them. Furthermore, the st	udents can explain the environmental benefit	s from the use of such	systems.
Skills	Students are able to apply methodologies for detailed det	ermination of energy demand or energy pro	duction for various t	voes of energy systems.
	Furthermore, they can evaluate energy systems technical			
	Therefore, they can choose the necessary subject-specific ca		-	oonam given conditione.
	Therefore, they can choose the necessary subject-specific ca	iculation rules, also for not standardized sold	nons of a problem.	
	The students are able to explain questions and possible app	proaches to its processing from the field of re	newable energies ora	ally and to put them them
	into the right context.			
Personal Competence				
Social Competence	The students are able to analyze suitable technical alte	rnatives and to assess them with technical	al, economical and	ecological criteria under
	sustainability aspects. This allows them to make an effective	contribuition to a more sustainable power sup	ply.	
Autonomy	Students can independently exploit sources, acquire the par	ticular knowledge about the subject area and	transform it to now a	loctions
Autonomy	Students can independently exploit sources, acquire the par	licular knowledge about the subject area and	transionin it to new qu	iestions.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	3 hours written exam			
Assignment for the Following	General Engineering Science (German program); Specialisa	tion Energy and Enviromental Engineering: C	ompulsorv	
				rv
34.1104.4				*
			2	
			ampuleon/	
				.,
				*
	General Engineering Science (English program, / semester)	Specialisation Mechanical Engineering, Foc	us Energy Systems: E	elective Compulsory
Examination	Written exam	: Specialisation Energy and Enviromental En : Specialisation Mechanical Engineering, For compulsory ion Energy and Enviromental Engineering: C : Specialisation Energy and Enviromental Eng	gineering: Compulsor cus Energy Systems: I ompulsory gineering: Compulsor	Elective Compulsory

Course L0316: Power Industry	
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Martin Kaltschmitt, Dr. Andreas Wiese
Language	DE
Cycle	SoSe
Content	 Electrical energy in the energy system Demand and use of electrical energy (households, industry, "new" buyers (including e-mobility)) Electricity generation electricity generation technologies using fossil fuels and their characteristics combined heat and power technologies and their production characteristics electricity generation from renewable energy technologies and their characteristics Power distribution "classic" distribution of electrical energy challenges of fluctuating electricity generation by distributed systems (electricity market, electricity stock exchange, emissions trading) District heating industry Legal and administrative aspects Energy Act support instruments for renewable energy CHP Act Cost and efficiency calculation
Literature	Folien der Vorlesung



Course L0315: Energy Systems and Energy Industry		
Тур	cture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Martin Kaltschmitt	
Language	DE	
Cycle	SoSe	
Content	Energy: development and significance Fundamentals and basic concepts Energy demand and future trends (heat, electricity, fuels) Energy reserve and sources Cost and efficiency calculation Final and effective energy from petroleum, natural gas, coal, uranium and other Legal, administrative and organizational aspects of energy systems Energy systems as a permanent optimization task	
Literature	Kopien der Folien	

Course L0313: Renewable Energy	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Kaltschmitt
Language	DE/EN
Cycle	SoSe
Content	 introduction solar energy for heat and power generation wind power for electricity generation hydropower for electricity generation ocean energy for electricity generation geothermal energy for heat and electricity generation
Literature	 Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2006, 4. Auflage Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Renewable Energy - Technology, Economics and Environment; Springer, Berlin, Heidelberg, 2007

Course L1434: Renewable Energy		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Martin Kaltschmitt	
Language	DE/EN	
Cycle	SoSe	
Content	Students work on different tasks in the field of renewable energies. They present their solutions in the exercise lesson and discuss it with other students	
Literature	and the lecturer. Possible tasks in the field of renewable energies are: Solar thermal heat Concentrating solare power Photovoltaic Windenergie Hydropower Heat pump Deep geothermal energy	
Literature	 Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2006, 4. Auflage Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Renewable Energy - Technology, Economics and Environment; Springer, Berlin, Heidelberg, 2007 	



Module M0538: Heat and M	lass Transfer			
Courses				
Title		Тур	Hrs/wk	CP
Heat and Mass Transfer (L0101)		Lecture	2	2
Heat and Mass Transfer (L0102)		Recitation Section (small)	1	2
Heat and Mass Transfer (L1868)		Recitation Section (large)	1	2
Module Responsible	Prof. Irina Smirnova			
Admission Requirements	None			
Recommended Previous	Basic knowledge: Technical Thermodynamics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fo	ollowing learning results		
Professional Competence				
Knowledge				
Mowicage	The students are capable of explaining qualitativ	e and determining quantitative heat transfer in	procedural apparatu	s (e. g. heat exchange
	chemical reactors).			
	They are capable of distinguish and characterize of	different kinds of heat transfer mechanisms nam	ely heat conduction, l	neat transfer and therma
	radiation.			
	The students have the ability to explain the physical	al basis for mass transfer in detail and to describ	e mass transfer quali	tative and quantitative b
	using suitable mass transfer theories.			
	They are able to depict the analogy between heat-	and mass transfer and to describe complex links	ed processes in detail	
Skills		soundaries for a given transport problem by usi	na the animed knowl	adaa and ta balanaa th
	The students are able to set reasonable system be according to the students are able to set reasonable system be according to the students.		ng the gained knowl	eage and to barance in
	corresponding energy and mass flow, respectively.			
	They are capable to solve specific heat transfer p	roblems (e.g. heated chemical reactors, temper	ature alteration in flu	ids) and to calculate th
	corresponding heat flows.			
	Using dimensionless quantities, the students can e	xecute scaling up of technical processes or appa	aratus.	
	They are able to distinguish between diffusion, co	invective mass transition and mass transfer. Th	ey can use this know	ledge for the description
	and design of apparatus (e.g. extraction column, re	ctification column).		
	In this context, the students are capable to choose	ose and design fundamental types of heat an	d mass exchanger f	or a specific application
	considering their advantages and disadvantages, r	espectively.		
	 In addition, they can calculate both, steady-state ar 	nd non-steady-state processes in procedural app	aratus.	
	The students are capable to connect their know	rledge obtained in this course with knowlegd	e of other courses (In particular the course
	thermodynamics, fluid mechanics and chemical pro	ocess engineering) to solve concrete technical p	roblems.	
Personal Competence				
Social Competence				
eedia. eempelenee	The students are capable to work on subject-speci	fic challenges in teams and to present the resul	ts orally in a reasona	ble manner to tutors an
	other students.			
Autonomy				
riateriemy	The students are able to find and evaluate necessar	ary information from suitable sources		
	They are able to prove their level of knowledge	e during the course with accompanying proce	dure continuously (d	clicker-system, exam-lik
	assignments) and on this basis they can control the	eir learning processes.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points				
•				
Examination				
Examination duration and scale	120 minutes; theoretical questions and calculations			
Assignment for the Following	General Engineering Science (German program): Speciali	sation Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Speciali	sation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Speciali	sation Energy and Enviromental Engineering: C	ompulsory	
	General Engineering Science (German program, 7 semes	ter): Specialisation Process Engineering: Compu	ilsory	
	General Engineering Science (German program, 7 semes	ter): Specialisation Bioprocess Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semes	ter): Specialisation Energy and Enviromental En	gineering: Compulsor	y
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification	n: Compulsory		
	General Engineering Science (English program): Specialis		mpuloo::	
	General Engineering Science (English program): Specialis		ompulsory	
	General Engineering Science (English program): Specialis			
	General Engineering Science (English program, 7 semest	er): Specialisation Process Engineering: Compu	Isory	
	General Engineering Science (English program, 7 semestr	er): Specialisation Bioprocess Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semest	er): Specialisation Energy and Enviromental Eng	ineering: Compulsor	y
	Technomathematics: Specialisation III. Engineering Science	ce: Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsi			
	Process Engineering: Core qualification: Compulsory	-		
	1 1000000 Engineering. Oute qualification. Compuisory			



Course L0101: Heat and Mass Transfer		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	WiSe	
Content	1. Heat transfer Introduction, one-dimensional heat conduction Convective heat transfer Multidimensional heat conduction Non-steady heat conduction Thermal radiation Mass transfer one-way diffusion, equimolar countercurrent diffusion boundary layer theory, non-steady mass transfer Heat and mass transfer single particle/ fixed bed Mass transfer and chemical reactions	
Literature	H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer VDI-Wärmeattas	

Course L0102: Heat and Mass Trans	course L0102: Heat and Mass Transfer	
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	2	
Workload in Hours	dependent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Irina Smirnova	
Language	Language DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

ourse L1868: Heat and Mass Transfer	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0546: Thermal Se	eparation Processes			
Courses				
Title		Тур	Hrs/wk	СР
Thermal Separation Processes (L0118)		Lecture	2	2
Thermal Separation Processes (L0119)		Recitation Section (small)	2	2
Thermal Separation Processes (L0141)		Recitation Section (large)	1	1
Separation Processes (L1159)	T	Laboratory Course	1	1
Module Responsible	Prof. Irina Smirnova			
Admission Requirements	None			
Recommended Previous Knowledge	Recommended requirements: Thermodynamics III			
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	The students can distinguish and describe differe the students develop an understanding for the corprocess, the possibilities of energy saving, and the	course of concentration during a separation pro e selection of separation systems		
Skills	 They have good knowledge of designing method Using the gained knowledge the students can se 		separation process and	can close the associated
	 energy and material balances The students can use different graphical methods for the designing of a separation process and define the amount of theoretical stages requirer They can select and design a basic type of thermal separation process for a given case based on the advantages and disadvantages of the process The students are capable to obtain independently the needed material properties from appropriate sources (diagrams and tables) They can calculate continuous and discontinuous processes The students are able to prove their theoretical knowledge in the experimental lab work. The students are able to discuss the theoretical background and the content of the experimental work with the teachers in colloquium. The students are capable of linking their gained knowledge with the content of other lectures and use it together for the solution of technical problem. Other lectures such as thermodynamics, fluid mechanics and chemical engineering. 		nd disadvantages of the id tables)	
Personal Competence Social Competence	The students can work technical assignments in s The students are able to carry out practical lab w.			n them. They are able to
	discuss their results and to document them scient		anvision or labor betwee	in them. They are dole to
Autonomy	The students are capable to obtain the needed in The students can proof the state of their knowledges.	•	, ,	ing process
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes; theoretical questions and calculations			
Assignment for the Following	General Engineering Science (German program): Specia	Ilisation Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specia			
	General Engineering Science (German program): Specia	lisation Energy and Enviromental Engineering	: Compulsory	
		0, 0	, ,	
	General Engineering Science (German program, 7 seme	ster): Specialisation Process Engineering: Com	npulsory	
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme	ster): Specialisation Process Engineering: Com ster): Specialisation Bioprocess Engineering: C	npulsory Compulsory	v
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme	ster): Specialisation Process Engineering: Conster): Specialisation Bioprocess Engineering: Caster): Specialisation Energy and Enviromental	npulsory Compulsory	у
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory	ster): Specialisation Process Engineering: Conster): Specialisation Bioprocess Engineering: Coster): Specialisation Energy and Enviromental	npulsory Compulsory	у
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification	ster): Specialisation Process Engineering: Conster): Specialisation Bioprocess Engineering: Coster): Specialisation Energy and Enviromental Conster): Specialisation Energy and Enviromental Consterns Compulsory	npulsory Compulsory	у
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Specia	ster): Specialisation Process Engineering: Conster): Specialisation Bioprocess Engineering: Coster): Specialisation Bioprocess Engineering: Coster): Specialisation Energy and Environmental in Compulsory In: Compulsory Iisation Bioprocess Engineering: Compulsory	npulsory Compulsory Engineering: Compulsor	у
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Special General Engineering Science (English program): Special	ster): Specialisation Process Engineering: Conster): Specialisation Bioprocess Engineering: Coster): Specialisation Bioprocess Engineering: Coster): Specialisation Energy and Environmental in Compulsory Ilisation Bioprocess Engineering: Compulsory Ilisation Energy and Environmental Engineering:	npulsory Compulsory Engineering: Compulsor	у
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Specia General Engineering Science (English program): Specia General Engineering Science (English program): Specia	ster): Specialisation Process Engineering: Conster): Specialisation Bioprocess Engineering: Coster): Specialisation Energy and Environmental Constering: Compulsory Compulsory Bisation Energy and Environmental Engineering: Compulsory Bisation Energy and Environmental Engineering: Bisation Process Engineering: Compulsory Bisation Process Engineering: Compulsory	npulsory Compulsory Engineering: Compulsor Compulsory	у
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Special General Engineering Science (English program, 7 semestations)	ster): Specialisation Process Engineering: Conster): Specialisation Bioprocess Engineering: Coster): Specialisation Energy and Environmental Consteriors: Compulsory Service Bioprocess Engineering: Compulsory Service Energy and Environmental Engineering: Specialisation Process Engineering: Compulsory Ster): Specialisation Process Engineering: Compulsory Ster): Specialisation Process Engineering: Compulsory	npulsory Compulsory Engineering: Compulsor Compulsory	у
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Specia General Engineering Science (English program): Specia General Engineering Science (English program): Specia	ster): Specialisation Process Engineering: Conster): Specialisation Bioprocess Engineering: Coster): Specialisation Bioprocess Engineering: Coster): Specialisation Energy and Environmental Indication Bioprocess Engineering: Compulsory Ilisation Bioprocess Engineering: Compulsory Bisation Process Engineering: Compulsory Ster): Specialisation Process Engineering: Comster): Specialisation Bioprocess Engineering: Comster B	npulsory Compulsory Engineering: Compulsor Compulsory pulsory ompulsory	



Course L0118: Thermal Separation	Processes
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry's Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann's Enzyklopädie der Technischen Chemie



Course L0119: Thermal Separation	Processes	
Тур	Recitation Section (small)	
Hrs/wk	2	
СР		
Workload in Hours	ependent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	WiSe	
Content	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes The students work on tasks in small groups and present their results in front of all students.	
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann's Enzyklopädie der Technischen Chemie 	



Course L0141: Thermal Separation	Processes	
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	ependent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	WiSe	
Content	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes	
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann"s Enzyklopädie der Technischen Chemie 	



Course L1159: Separation Processe	es		
Тур	Laboratory Course		
Hrs/wk	1		
СР			
Workload in Hours	dependent Study Time 16, Study Time in Lecture 14		
Course work	ompulsory attendence of the colloquia of all experiments and compulsory report.		
Lecturer	Prof. Irina Smirnova		
Language	DE/EN		
Cycle	SoSe		
Content	The students work on eight different experiments in this practical course. For every one of the eight experiments, a colloquium takes place in which th		
	students explain and discuss the theoretical background and its translation into practice with staff and fellow students.		
	The students work small groups with a high degree of division of labor. For every experiment, the students write a report. They receive instructions i terms of scientific writing as well as feedback on their own reports and level of scientific writing so they can increase their capabilities in this area.		
	Topics of the practical course:		
	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes		
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkop Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann Enzyklopädie der Technischen Chemie 		



Courses				
Title		Тур	Hrs/wk	CP
Gas and Steam Power Plants (L0206)		Lecture	3	4
Gas and Steam Power Plants (L0210)	I	Recitation Section (large)	2	2
Module Responsible	Prof. Alfons Kather			
Admission Requirements	None			
Recommended Previous	The best of the consideration band III			
Knowledge	"Technical Thermodynamics I and II" "Heat Transfer"			
	"Fluid Mechanics"			
Educational Objectives	After taking part successfully, students have reached	d the following learning results		
Professional Competence				
Knowledge	· ·	electricity demand and the energy conversion routes i		
		generator block. They are also able to determine th		
	solar thermal and geothermal power plants or plant	eaning apparatus and the combination possibilities on s equipped with Carbon Capture and Storage.	of conventional fossil-	uelled power plants
	The students have basic knowledge about the princ			
OI::II-	The students will be able using theories and analysis	nde of the energy technology from foodl finds and be-	end on wall founded by	nowledge on the fire
SKIIIS	-	ods of the energy technology from fossil fuels and bas to identify basic associations in the production of he		
	* ' ' '	posure to the inherent interplay between heat and po		
		optimal concepts for the generation of electricity and the	•	
		deliberations on the electricity mix composition within		
	supply and environmental protection).			
	Mishing the forces of the constitution that the	FROM C	NI Danfannian al TM NAG	de de la casa II a casa II a casa II
	Within the framework of the exercise the students learn the use of the specialised software suite EBSILON Professional TM. With this tool tasks are solved with the PC, to highlight aspects of the design and development of power plant cycles.		ir iriis toor siriali prac	
	The students are able to do simplified calculations on turbomachinery either as part of a plant, as single component or at stage level.		evel	
	The statents are able to do simplified calculations of	in turbomacimery entier as part of a plant, as single of	omponent of at stage i	evei.
Personal Competence	As a construction with in the framework of the leading in	along and for at indepted that are interested. The at indepted		
Social Competence	· ·	planned for students that are interested. The students	-	
	technical and political issues.	n first-hand experience with a power plant in operation	on and gain insignis i	nto the conflicts bety
Autonomy	·	develop alone simple simulation models and run wi	th these scenario ana	lyses. In this manne
riatoriomy	· ·	ture is consolidated and the potential effects from		•
		ependently to analyse the operational performance		
	quantities and characteristic curves.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture	70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	Written examination of 120 min			
Assignment for the Following		pecialisation Energy and Enviromental Engineering: (
Curricula		pecialisation Mechanical Engineering, Focus Energy		
		semester): Specialisation Energy and Environmental En		-
		semester): Specialisation Mechanical Engineering, Fo	cus Energy Systems:	Elective Compulsory
	Energy and Environmental Engineering: Core quali	fication: Compulsory pecialisation Energy and Enviromental Engineering: C	Compulsory	
		pecialisation Energy and Environmental Engineering. C pecialisation Mechanical Engineering, Focus Energy S		
		semester): Specialisation Energy and Enviromental En		у
		semester): Specialisation Mechanical Engineering, Fo		
			,	, , ,



Course L0206: Gas and Steam Pow	er Plants
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Alfons Kather
Language	DE
Cycle	WiSe
Content	In the 1 st part of the lecture an overview on thermal power plants is offered, including:
	Electricity demand and Forecasting
	Thermodynamic fundamentals
	Energy Conversion in thermal power plants
	Types of power plant
	Layout of the power plant block
	Individual elements of the power plant
	Cooling systems
	Flue gas cleaning
	Operation characteristics of the power plant
	Construction materials for power plants
	Location of power plants
	Solar thermal plants/geothermal plants/Carbon Capture and Storage plants.
	These are complemented in the 2 nd part of the module by the more specialised issues:
	Energy balance of a turbomachine
	Theory of turbine and compressor stage
	Equal and positive pressure blading
	Flow losses
	Characteristic numbers
	Axial and radial design
	Design features
	Hydraulic turbomachines
	Pump and water turbine designs
	Design examples of reciprocating engines and turbomachinery
	Steam power plants
	Gas turbine systems.
Literature	Kalide: Kraft- und Arbeitsmaschinen
	Thomas, H.J.: Thermische Kraftanlagen. Springer-Verlag, 1985
	Strauß, K.: Kraftwerkstechnik. Springer-Verlag, 2006
	Kugeler und Phlippen: Energietechnik. Springer-Verlag, 1990
	Bohn, T. (Hrsg.): Handbuchreihe Energie, Band 7: Gasturbinenkraftwerke, Kombikraftwerke, Heizkraftwerke und Industriekraftwerke, Technischer
	Verlag Resch / Verlag TÜV Rheinland



	er Plants	
Тур	Recitation Section (large)	
Hrs/wk	2	
СР		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Alfons Kather	
Language	DE	
Cycle	WiSe	
Content	In the 1 st part of the lecture a general introduction into fluid-flow machines and steam power plants is offered, including:	
	in the 1 part of the fecture a general introduction into hold indefines and steam power plants is offered, including.	
	Energy balance of a fluid-flow machine	
	Theory of turbine and compressor stage	
	Equal and positive pressure blading	
	Flow losses	
	Characteristic numbers	
	Axial and radial design	
	Design features	
	Hydraulic fluid-flow machines	
	Pump and water turbine designs	
	Design examples of reciprocating engines and turbomachinery	
	Steam power plants	
	Gas turbine systems	
	Diesel engine systems	
	Waste heat utilisation	
	followed by the more specialised issues:	
	Electricity Demand and Forecasting	
	Thermodynamic fundamentals	
	Energy Conversion in Thermal Power Plants	
	Types of Power Plant	
	Layout of the power plant block	
	Individual elements of the power plant	
	Cooling systems	
	Flue gas cleaning	
	Operation characteristics of the power plant	
	Construction materials	
	Location of power plants	
	The environmental impact of acidification, fine particulate or CO ₂ emissions and the resulting climatic effects are a special focus of the lecture and	
	lecture hall exercise. The challenges in plant operation from interconnecting conventional power plants and renewable energy sources are discus	
	and the technical options for providing security of supply and network stability are presented, also under consideration of cost effectiveness. In	
	critical review, focus is especially placed on the compatibility of the different solutions with the environment and climate. With this, the awareness for	
	responsibility of an engineer's own actions are emphasized and the potential extent of the different solutions presented clearly.	
	responsibility of an engineer south action and emphasized and the potential exerted the dilutions presented slearly.	
	Within the framework of the exercise the students learn the use of the specialised software suite EBSILON Professional TM. With this tool small tasks	
	solved on the PC, to highlight aspects of the design and development of power plant cycles. The students present their results orally and can afterware	
	ask questions and get feedback. The course work has a positive effect on the students final grade.	
Literature	Skripte	
	Kalide: Kraft- und Arbeitsmaschinen	
	Thomas, H.J.: Thermische Kraftanlagen. Springer-Verlag, 1985	
	Strauß, K.: Kraftwerkstechnik. Springer-Verlag, 2006	
	Kugeler und Phlippen: Energietechnik. Springer-Verlag, 1990	
	T. Bohn (Hrsg.): Handbuchreihe Energie, Band 7: Gasturbinenkraftwerke, Kombikraftwerke, Heizkraftwerke und Industriekraftwerke, Technisc	



Module M0956: Measureme	ent Technology for Mechanical and Process E	Engineers		
Courses				
Title		Тур	Hrs/wk	СР
Practical Course: Measurement and Conti	rol Systems (L1119)	Laboratory Course	2	2
Measurement Technology for Mechanical	and Process Engineers (L1116)	Lecture	2	3
Measurement Technology for Mechanical	and Process Engineers (L1118)	Recitation Section (large)	1	1
Module Responsible	Dr. Sven Krause			
Admission Requirements	none			
Recommended Previous	Basic knowledge of physics, chemistry and electrical enginee	ring		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	Students are able to name the most important fundmentals of	of the Measurement Technology (Quantities	and Units, Uncertainty	, Calibration, Static ar
	Dynamic Properties of Sensors and Systems).			
	They can outline the most important measuring methods for o	different kinds of quantities to be maesured (Electrical Quantities.	Temperature, mechanic
	quantities, Flow, Time, Frequency).			
	They can describe important methods of chemical Analysis (G	Gas Sensors, Spectroscopy, Gas Chromatogr	aphy)	
Skills	Students can select suitable measuring methods to given pro-	blems and can use refering measurement de	vices in practice.	
	The students are able to orally explain issues in the subject area of measurement technology and solution approaches as well as place the issues in			
	the right context and application area.	area of measurement technology and solution	лі арріоаспез аз жеі	i as piace the issues in
	are ngm comon and approximation area.			
Personal Competence				
Social Competence	Students can arrive at work results in groups and document the	nem in a common report.		
Autonomy	Students are able to familiarize themselves with new measure	ement technologies.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	105 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisat	ion Energy and Environmental Engineering: (Compulsory	
Curricula	General Engineering Science (German program): Specialisat		ompulsory	
Garriodia	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program, 7 semester)		gineering: Compulsor	γ
	General Engineering Science (German program, 7 semester)			-
	General Engineering Science (German program, 7 semester)			
	General Engineering Science (German program, 7 semester)			
	Energy and Environmental Engineering: Core qualification: C		-	
	General Engineering Science (English program): Specialisati	on Energy and Enviromental Engineering: C	ompulsory	
	General Engineering Science (English program): Specialisati	on Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisati	on Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisati	on Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester):	Specialisation Energy and Environmental En	gineering: Compulsor	y
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering: Co	mpulsory	
	General Engineering Science (English program, 7 semester):	Specialisation Biomedical Engineering: Cor	npulsory	
	General Engineering Science (English program, 7 semester):	Specialisation Process Engineering: Compu	ilsory	
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Process Engineering: Core qualification: Compulsory			



Course L1119: Practical Course: Measurement and Control Systems		
Тур		
Hrs/wk	2	
СР	2	
Workload in Hours	ndependent Study Time 32, Study Time in Lecture 28	
Lecturer	r. Wolfgang Schröder	
Language	DE	
Cycle	WiSe/SoSe	
Content	Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants in automotive exhaust are used.	
	Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated. The starting will be simulated on a PC and compared with measurement.	
	Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michelson interferometer and optical fibers demonstrated.	
	Experiment 4:Identification of the parameters of a control system and optimal control parameters	
Literature	Versuch 1:	
	 Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftliche Verlagsgesellschaft, Stuttgart, 1974 Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, München-Wien, 1979 Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung Gebrauchs- und Bedienungsanweisungen VDI-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 Bl.1, 2451 Bl.4, 2453 Bl.5, 2455 Bl.1 Versuch 2: Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren Simulationsmethoden, speziell: Verwendung von Blockschaltbildern Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984 Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1988 Culshaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989 Versuch 4: Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden Jan Lunze: Systemtheoretische Grundlagen, Analyse und Entwurf einschleifiger Regelungen 	



Course L1116: Measurement Techn	ology for Mechanical and Process Engineers
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer Language	Dr. Sven Krause DE
Cycle	WiSe WiSe
Content	1 Fundamentals
	1.1 Quantities and Units
	1.2 Uncertainty
	1.3 Calibration
	1.4 Static and Dynamic Properties of Sensors and Systems
	2 Measurement of Electrical Quantities
	2.1 Current and Voltage
	2.2 Impedance
	2.3 Amplification
	2.4 Oscilloscope
	2.5 Analog-to-Digital Conversion
	2.6 Data Transmission
	3 Measurement of Nonelectric Quantities
	3.1 Temperature
	3.2 Length, Displacement, Angle
	3.3 Strain, Force, Pressure
	3.4 Flow
	3.5 Time, Frequency
	4 Chemical Analysis
	4.1 Gas Sensors
	4.2 Spectroscopy
	4.3 Gas Chromatography
	At the end of each lecture students present single measuring techniques and results orally in front of the class.
Literature	Lerch, R.: "Elektrische Messtechnik; Analoge, digitale und computergestützte Verfahren", Springer, 2006, ISBN: 978-3-540-34055-3.
	Profos, P. Pfeifer, T.: "Handbuch der industriellen Messtechnik", Oldenbourg, 2002, ISBN: 978-3486217940.
	<u>L</u>

Course L1118: Measurement Technology for Mechanical and Process Engineers	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Sven Krause
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M1275: Environme	ntal Technology			
Courses				
Title		Тур	Hrs/wk	СР
Practical Exercise Environmental Technol	ogy (L1387)	Laboratory Course	1	1
Environmental Technologie (L0326)		Lecture	2	2
Module Responsible	Dr. Joachim Gerth			
Admission Requirements	None			
Recommended Previous	Fundamentals of inorganic/organic chemistry and biology			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following I	earning results		
Professional Competence				
Knowledge	With the completion of this modul the students obtain profound k	nowledge of environmental technological	ogy. They are able to de	escribe the behaviour of
	chemicals in the environment. Students can give an overview of	scientific disciplines involved. They	can explain terms and	allocate them to related
	methods.			
Skille	Students are able to propose appropriate management and mitiga	tion massures for anyironmental are	blome Thoy are able to	dotormino googhomical
Skills	parameters and to assess the potential of pollutants to migrate			
	Environmental Technology contributes to sustainable development			·
	Environmental resimology contributes to sustainable development	, and may our present and delend in	osc opinions in noncora	na agamst the group.
Personal Competence				
Social Competence	The students are able to discuss the various technical and scientific tasks, both subject-specific and multidisciplinary. They are able to develop differen			
	approaches to the task as a group as well as to discuss their theore	tical or practical implementation.		
Autonomy	Students can independently exploit sources about of the subject, ac	equire the particular knowledge and t	ranfer it to new problems	S.
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Examination	Written exam			
Examination duration and scale	1 hour written exam			
Assignment for the Following	General Engineering Science (German program): Specialisation Er	nergy and Enviromental Engineering	: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Pr	ocess Engineering: Elective Compul	sory	
	General Engineering Science (German program, 7 semester): Spec	cialisation Energy and Enviromental	Engineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Elec	tive Compulsory	
	General Engineering Science (German program, 7 semester): Spec	cialisation Bioprocess Engineering: E	lective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsory			
	Energy and Environmental Engineering: Core qualification: Compu	Isory		
	General Engineering Science (English program): Specialisation En	**		
	General Engineering Science (English program): Specialisation Program			
	General Engineering Science (English program, 7 semester): Spec	••		′
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): Spec	ialisation Bioprocess Engineering: E	lective Compulsory	
	Process Engineering: Core qualification: Elective Compulsory			

Course L1387: Practical Exercise Environmental Technology		
Тур	Laboratory Course	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Joachim Gerth	
Language	DE	
Cycle	SoSe	
	The experiment demonstrates the effect of ionic strength on the binding of dissolved zinc and phosphate by soil surfaces. From the results it can be inferred that the potential of soil surfaces is modified by the application of salt. This has consequences for the retention of nutrients and pollutants. The experiment is carried out with iron oxide rich soil material. Within the lab course students discuss the various technical and scientific tasks, both subject-specific and multidisciplinary. They discuss different approaches to the task as well as it's theoretical or practical implementation.	
Literature	F. Scheffer und P. Schachtschabel (2002): "Lehrbuch der Bodenkunde" TUB Signatur AGG-308 W.E.H. Blum (2007): "Bodenkunde in Stichworten" TUB Signatur AGG-317 C. A. J. Appelo; D. Postma (2005): "Geochemistry, groundwater and pollution" TUB Signatur GWC-515	



Course L0326: Environmental Tech	nologie
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Joachim Gerth, Prof. Martin Kaltschmitt, Prof. Kerstin Kuchta
Language	DE
Cycle	WiSe
Content	1. Introductory seminar on environmental science: 2. Environmental impact and adverse effects 3. Wastewater technology 4. Air pollution control 5. Noise protection 6. Waste and recycling management 7. Soil and ground water protection 8. Renewable energies 9. Resource conservation and energy efficiency
Literature	Förster, U.: Umweltschutztechnik; 2012; Springer Berlin (Verlag) 8., Aufl. 2012; 978-3-642-22972-5 (ISBN)



-		
Courses		
Title	Typ Hrs/wk CP	
ntroduction to Control Systems (L0654)	Lecture 2 4 Recitation Section (small) 2 2	
atroduction to Control Systems (L0655)		
Module Responsible		
Admission Requirements		
Recommended Previous		
Knowledge	, 	
Educational Objectives		
Professional Competence		
Knowledge	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and	id second ord
	systems	
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root loops.	cus
	They can explain the Nyquist stability criterion and the stability margins derived from it.	
	They can explain the role of the phase margin in analysis and synthesis of control loops	
	They can explain the way a PID controller affects a control loop in terms of its frequency response	
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally	
01.11		
Skills	Students can transform models of linear dynamic systems from time to frequency domain and vice versa	
	They can simulate and assess the behavior of systems and control loops	
	They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules	
	They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques	
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation	
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks	
Davis and Commistance		
Personal Competence		
Social Competence		
Autonomy		n solving giv
	problems.	
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Credit points	6	
Examination	Mritten exam	
Examination duration and scale	120 min	
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory	
Assignment for the Following Curricula		
· ·		
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
0	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Covil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory	
0	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	
0	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory	
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	g: Compulso
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	g: Compulso
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering	g: Compulso ering Scienc
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering	g: Compulso ering Scienc
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical	g: Compulso ering Scienc al Engineeri
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Compulsory	g: Compulso ering Scienc al Engineeri
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica	g: Compulso ering Scienc al Engineeri and Producti
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory	g: Compulso ering Scienc al Engineeri and Producti
0	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory	g: Compulso ering Scienc al Engineeri and Producti
0	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory	g: Compulso ering Scienc al Engineeri and Producti
0	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory	g: Compulso ering Scienc al Engineeri and Producti
0	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory	g: Compulso ering Scienc al Engineeri and Producti
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Energy and Environmental Engineering: Core qualification: Compulsory	g: Compulso ering Scienc al Engineeri and Producti
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering Science (English program): Core qualification: Compulsory	g: Compulso ering Scienc al Engineeri and Producti
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsor	g: Compulso ering Scienc al Engineeri and Producti
0	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Compulsory General Engineering Science (English program, 7 semester): Specialisation C	g: Compulso ering Science al Engineeri and Producti
0	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory General Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English progr	g: Compulso ering Science al Engineeri and Producti
· ·	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Raval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanica Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Gener	g: Compulso ering Scienc al Engineerin and Production
0	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development at Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engi	g: Compulso ering Scienc al Engineeri and Producti



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

e L0654: Introduction to Contr	or Systems	
Тур	Lecture	
Hrs/wk	2	
СР		
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28	
Lecturer	Prof. Herbert Werner	
Language	DE	
Cycle	WiSe	
Content	Signals and systems	
	 Linear systems, differential equations and transfer functions First and second order systems, poles and zeros, impulse and step response 	
	Stability	
	- Gabinity	
	Feedback systems	
	Principle of feedback, open-loop versus closed-loop control	
	Reference tracking and disturbance rejection	
	Types of feedback, PID control	
	System type and steady-state error, error constants	
	Internal model principle	
	Root locus techniques	
	Root locus plots	
	Root locus design of PID controllers	
	Frequency response techniques	
	Bode diagram	
	Minimum and non-minimum phase systems	
	Nyquist plot, Nyquist stability criterion, phase and gain margin	
	Loop shaping, lead lag compensation	
	Frequency response interpretation of PID control	
	Time delay systems	
	• Post logge and frequency reasons of time delay systems	
	 Root locus and frequency response of time delay systems Smith predictor 	
	Digital control	
	Sampled data systems difference equations	
	 Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers 	
	Software tools	
	 Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course 	
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"	
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009	
	G.F. Franklin, J.D. Powell and A. Emami-Naeimi. Feedback Control of Dynamic Systems, Addison Wesley, Reading, MA, 2009 K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010	
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010	



Course L0655: Introduction to Control Systems	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0670: Particle Ted	chnology and Solids Process Engineering			
Courses				
		Torr	Llua hade	CP
Title		Typ	Hrs/wk 2	3
Particle Technology I (L0434) Particle Technology I (L0435)		Lecture Recitation Section (small)	1	1
Particle Technology I (L0440)		Laboratory Course	2	2
Module Responsible	Prof. Stefan Heinrich	•		
Admission Requirements	None			
Recommended Previous	keine			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	After successful completion of the module students are able to			
	and the second s			
	 name and explain processes and unit-operations of solid: characterize particles, particle distributions and to discuss 			
	Characterize particles, particle distributions and to discuss	titeli bulk properties		
Skills	Students are able to			
S.i.i.e				
	 choose and design apparatuses and processes for solids 		ds properties of the pro	duct
	 asses solids with respect to their behavior in solids proces 	sing steps		
	 document their work scientifically. 			
Personal Competence				
Social Competence	The students are able to discuss scientific topics orally with other	students or scientific personal and to de	velop solutions for tech	nnical-scientific issues in
	a group.			
Autonomy	Students are able to analyze and solve questions regarding solid	particles independently.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation	Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation	Energy and Enviromental Engineering: C	Compulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Bioprocess Engineering: Co	mpulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Energy and Enviromental En	gineering: Compulsory	/
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Comp	•		
	General Engineering Science (English program): Specialisation E			
	General Engineering Science (English program): Specialisation E		ompulsory	
	General Engineering Science (English program): Specialisation F			
	General Engineering Science (English program, 7 semester): Spe		•	
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe	cialisation Energy and Enviromental En	gineering: Compulsory	,
	Process Engineering: Core qualification: Compulsory			



Course L0434: Particle Technology	l Control of the Cont
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	 Description of particles and particle distributions Description of a separation process Description of a particle mixture Particle size reduction Agglomeration, particle size enlargement Storage and flow of bulk solids Basics of fluid/particle flows classifying processes Separation of particles from fluids Basic fluid mechanics of fluidized beds Pneumatic and hydraulic transport
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.

Course L0435: Particle Technology	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0440: Particle Technology	l
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	 Sieving Bulk properties Size reduction Mixing Gas cyclone Blaine-test, filtration Sedimentation
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.



Courses				
Title		Тур	Hrs/wk	CP
Environmental Assessment (L0860)		Lecture	2	2
Environmental Assessment (L1054)		Recitation Section (small)	1	1
Module Responsible	Prof. Martin Kaltschmitt			
Admission Requirements	None			
Recommended Previous	Fundamentals of inorganic/organic chemistry and biology			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fo	llowing learning results		
Professional Competence				
Knowledge	With the completion of this module the students acquire in-	depth knowledge of important cause-effect ch	ains of potential enviro	nmental problems wi
	might occur from production processes, projects or constru	ction measures. They have knowledge about	the methodological dive	ersity and are compe
	in dealing with different methods and instruments to asse	ss environmental impacts. Besides the studer	nts are able to estimate	the complexity of th
	environmental processes as well as uncertainties and diffic	ulties with their measurement.		
Skills	The students are able to select a suitable method for the	respective case from the variety of assessme	nt methods. Thereby th	ey can develop suita
	solutions for managing and mitigating environmental pro-	oblems in a business context. They are abl	e to carry out Life Cyc	cle Impact Assessme
	independently and can apply the software programs Open		ng the course the studer	its have the compete
	to critically judge research results or other publications on e	environmental impacts.		
Personal Competence				
Social Competence	The students are able to discuss the various technical and	d scientific tasks, both subject-specific and m	ultidisciplinary. They an	e able to develop in
Social Competence	different solutions and to discuss their theoretical or pract			
	multi-layered issues of the environment protection and the			
	raised and which helps to raise their awareness of their futu			aras arese subjects
	Taised and which helps to false their awareness of their fatt	are social responsibilities in their role as engin		
Autonomy	The students learn to research, process and present a sci	antific tonic independently. They are able to	carry out indopendent	scientific work. They
Autonomy	solve an environmental problem in a business context and			scientilic work. They
	Solve all environmental problem in a business context and	are able to judge results of other publications.		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Examination	Written exam			
Examination duration and scale	1 hour written exam			
Assignment for the Following	General Engineering Science (German program): Specialis	sation Energy and Environmental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specialis	**		
	General Engineering Science (German program, 7 semest		•	/
	General Engineering Science (German program, 7 semest	er): Specialisation Process Engineering: Electi	ive Compulsory	
	General Engineering Science (German program, 7 semest	er): Specialisation Bioprocess Engineering: El	ective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Comp		•	
	Energy and Environmental Engineering: Core qualification	: Compulsory		
	General Engineering Science (English program): Specialis		Compulsory	
	General Engineering Science (English program): Specialis			
	General Engineering Science (English program, 7 semeste	er): Specialisation Energy and Enviromental Er	ngineering: Compulsory	
	General Engineering Science (English program, 7 semeste			
	General Engineering Science (English program, 7 semeste			
	Process Engineering: Core qualification: Elective Compuls			
	Process Engineering: Core qualification: Compulsory			



Course L0860: Environmental Assessment	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Anne Rödl, Dr. Christoph Hagen Balzer
Language	DE/EN
Cycle	SoSe
Content	Contaminants: Impact- and Risk Assessment
	Environmental damage & precautionary principle: Environmental Risk Assessment (ERA)
	Resource and water consumption: Material flow analysis
	Energy consumption: Cumulated energy demand (CED), cost analysis
	Life cycle concept: Life cycle assessment (LCA)
	Sustainability: Comprehensive product system assessment, SEE-Balance
	Management: Environmental and Sustainability management (EMAS)
	Complex systems: MCDA and scenario method
Literature	Foliensätze der Vorlesung
	Studie: Instrumente zur Nachhaltigkeitsbewertung - Eine Synopse (Forschungszentrum Jülich GmbH)

Course L1054: Environmental Assessment	
Тур	Recitation Section (small)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Martin Kaltschmitt
Language	DE
Cycle	SoSe
Content	Presentation and application of free software programs in order to understand the concepts of environmental assessment methods better.
	Within the group exercise students discuss the various technical and scientific tasks, both subject-specific and multidisciplinary. They discuss different approaches to the task as well as it's theoretical or practical implementation.
Literature	Power point Präsentationen



Module M0891: Informatics	for Process Engineers			
Courses				
Title		Тур	Hrs/wk	CP
Informatics for Process Engineers (L0836		Lecture	2	2
Informatics for Process Engineers (L0837		Recitation Section (small)	2	2
Numeric and Matlab (L0125)		Laboratory Course	2	2
Module Responsible	Dr. Marcus Venzke			
Admission Requirements	None.			
Recommended Previous	Basic knowledge in using MS Windows.			
Knowledge				
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	Students can describe procedural and object-oriente	ed concepts.		
Skills	Students are capable of object-oriented programmin	g in the programing language Java and of solving n	nathematic questions by	using Matlab.
	Students are capable of developing concepts (simple	e algorithms) to solve technical questions.		
Personal Competence				
Social Competence	Students are able to work out solutions together in si	nall groups.		
Autonomy	- Indiana da de la Tara de la Tara da La da de la Calabara de la C			
Workload in Hours Credit points	Independent Study Time 96, Study Time in Lecture 8	4		
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Sp	pacialization Process Engineering: Elective Comput	conv	
Curricula				ampulcon/
Curricula	General Engineering Science (German program, 7 s			umpulsury
	General Engineering Science (German program, 7 s		live Compulsory	
	Bioprocess Engineering: Core qualification: Compul	·		
	Energy and Environmental Engineering: Core qualif			
	General Engineering Science (English program): Sp			
	General Engineering Science (English program, 7 se			ompulsory
	General Engineering Science (English program, 7 se		ive Compulsory	
	Process Engineering: Core qualification: Compulsor	у		



Course L0836: Informatics for Process Engineers		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Marcus Venzke	
Language	DE	
Cycle	SoSe	
Content	Introduction to object-oriented modelling and programming exemplified with Java	
	Objects, classes Methods, properties Inheritance Basics of the language Java Sample application: Simulation of an electricity network 2D graphics Events and Controls	
Literature	Campione, Mary; Walrath, Kathy: The Java Tutorial - A practical guide for programmers. Addison-Wesley, Reading, Massachusets, 1998. Bibliothek: TII 978 Krüger, Guido; Hansen, Heiko: Handbuch der Java-Programmierung. 3. Auflage Addison-Wesley, 2002. http://www.javabuch.de/ Krüger, Guido: Go to Java 2. Addison-Wesley Verlag, Bonn, 1999. Bibliothek: TII 717 Cowell, John: Essential Java 2 fast. Springer Verlag, London, 1999. Bibliothek: TII 942 Java SE 7 Documentation http://docs.oracle.com/javase/7/docs/ Java Platform, Standard Edition 7 API Specification http://docs.oracle.com/javase/7/docs/api/	

Course L0837: Informatics for Process Engineers		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Marcus Venzke	
Language	DE	
Cycle	SoSe	
Content	In the lab, the content from the lecture is practiced and deepened with practical assignments. Every week one or two programming tasks are assigned.	
	These are solved by the students on computers independently, coached by a tutor.	
Literature	Campione, Mary; Walrath, Kathy: The Java Tutorial - A practical guide for programmers. Addison-Wesley, Reading, Massachusets, 1998.	
	Bibliothek: TII 978	
	Krüger, Guido; Hansen, Heiko: Handbuch der Java-Programmierung. 3. Auflage Addison-Wesley, 2002.	
	http://www.javabuch.de/	
	Krüger, Guido: Go to Java 2. Addison-Wesley Verlag, Bonn, 1999.	
	Bibliothek: TII 717	
	Cowell, John: Essential Java 2 fast. Springer Verlag, London, 1999.	
	Bibliothek: TII 942	
	Java SE 7 Documentation	
	http://docs.oracle.com/javase/7/docs/	
	Java Platform, Standard Edition 7 API Specification	
	http://docs.oracle.com/javase/7/docs/api/	



Course L0125: Numeric and Matlab	
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Siegfried Rump, Weitere Mitarbeiter
Language	DE
Cycle	SoSe
Content	1. Programming in Matlab 2. Numerical methods for systems of nonlinear equations 3. Basics in computer arithmetic 4. Linear and nonlinear optimization 5. Condition of problems and algorithms 6. Verified numerical results with INTLAB
Literature	Literatur (Software-Teil): 1. Moler, C., Numerical Computing with MATLAB, SIAM, 2004 2. The Math Works, Inc., MATLAB: The Language of Technical Computing, 2007 3. Rump, S. M., INTLAB: Interval Labority, http://www.ti3.tu-harburg.de 4. Highham, D. J.; Highham, N. J., MATLAB Guide, SIAM, 2005



Module M0539: Process an	d Plant Engineering I			
Courses				
Title		Тур	Hrs/wk	СР
Process and Plant Engineering I (L0095)		Lecture	2	2
Process and Plant Engineering I (L0096)		Recitation Section (large)	1	2
Process and Plant Engineering I (L1214)		Recitation Section (small)	1	2
Module Responsible	Prof. Georg Fieg			
Admission Requirements	none			
Recommended Previous	unit operation of thermal an dmechanical separation processes			
Knowledge	chemical reactor eingineering			
Educational Objectives	After taking part successfully, students have reached the followin	g learning results		
Professional Competence				
Knowledge	students can:			
	classify and formulate blobal balance equations of chemical proc	esses		
	specify linear component equations of complex chemical process	ses		
	explain linear regression and data reconcilliation problems			
	explain pfd-diagrams			
Skills	students are capable of			
	- formulation of mass and energy balance equations and estimate			
	- estimation of component streams of chemical plants using linea	r component balance models		
	- solution of data reconcilliation tasks			
	- conduction of process synthesis			
	- economic evaluation of processes and the estimation of produc	ion costs		
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 Min. lectures notes and books			
Assignment for the Following	General Engineering Science (German program): Specialisation	Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Compul	sory	
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp	ecialisation Energy and Enviromental Eng	ineering: Elective Co	mpulsory
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): Sp			
	General Engineering Science (English program, 7 semester): Sp		•	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Energy and Enviromental Engi	neering: Elective Co	mpulsory
	Process Engineering: Core qualification: Compulsory			

Course L0095: Process and Plant Engineering I	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Course work	none
Lecturer	Prof. Georg Fieg
Language	DE
Cycle	SoSe
Content	1. Introduction Structure and operation of production plants Operational business process Technical process design Motivation and targets of process development Life cycle of production plants 2. Engineering methods and tools Mass and energy balances Strategies of process synthesis Graphical representation of processes Multidimensional regression



Module Manual B. Sc.	. "General Engineering Science (English program, 7 semester)"	urg-Hi
	Data reconciliation and data validation 3. Process Synthesis Decision levels Experimental process development Reactor synthesis Synthesis of separation processes (process alternatives and criteria for selection) Integration of reaction systems/separation systems (interactions, recycle streams) 4. Process safety 5. Cost estimation of production plants Production costs, capital costs, economic evaluation	
Literature		
	S.D. Barnicki, J.R. Fair, Ind. End. Chem., 29(1990), S. 421, Ind. End. Chem., 31(1992), S. 1679	
	H. Becker, S. Godorr, H. Kreis, Chemical Engineering, January 2001, S. 68-74	
	Behr, W. Ebbers, N. Wiese, ChemIngTech. 72(2000)Nr. 10, S.1157	
	E. Blass, Entwicklung verfahrenstechnischer Prozesse, Springer-Verlag, 2. Auflage 1997	
	M. H. Bauer, J. Stichlmair, ChemIngTech., 68(1996), Nr. 8, 911-916	
	R. Dittmeyer, W. Keim, G. Kreysa, A. Oberholz, Chemische Technik. Prozesse und Produkte,	
	Band 2, Neue Technologien, 5. Auflage, Wiley-VCH GmbH&Co.KGaA, Weinheim, 2004	
	J.M. Douglas, Conceptual Design of Chemical Processes, Mc Graw-Hill, NY, 1988 G. Fieg, Inz. Chem. Proc., 5(1979), S.15-19	
	G. Fieg, G. Wozny, L. Jeromin, Chem. Eng. Technol. 17(1994),5, 301-306	
	G. Fieg, Heat and Mass Transfer 32(1996), S. 205-213	
	G. Fieg, Chem. Eng. Processing, Vol. 41/2(2001), S. 123-133	
	U.H. Felcht, Chemie eine reife Industrie oder weiterhin Innovationsmotor, Universitätsbuchhandlung Blazek und Bergamann, Frankfurt, 2000	
	J.P. van Gigch, Systems Design, Modeling and Metamodeling, Plenum Press, New York, 1991	
	T.F. Edgar, D.M. Himmelblau, L.S. Lasdon, Optimization of Chemical Processes, McGraw-Hill, 2001	
	G. Gruhn, Vorlesungsmanuskript "Prozess- und Anlagentechnik, TU Hamburg-Harburg	
	D. Hairston, Chemical Engineering, October 2001, S. 31-37	
	J.L.A. Koolen, Design of Simple and Robust Process Plants, Wiley-VCH, Weinheim, 2002	
	J. Krekel, G. Siekmann, ChemIngTech. 57(1985)Nr. 6, S. 511	
	K. Machej, G. Fieg, J. Wojcik, Inz. Chem. Proc., 2(1981), S.815-824	
	S. Meier, G. Kaibel, ChemIngTech. 62(1990)Nr. 13, S.169	
	J. Mittelstraß, ChemIngTech. 66(1994), S. 309	
	P. Li, M. Flender, K. Löwe, G. Wozny, G. Fieg, Fett/Lipid 100(1998), Nr. 12, S. 528-534	
	G. Kaibel, Dissertation, TU München, 1987	

G. Kaibel, Dissertation, TU München, 1987

G. Kaibel, Chem.-Ing.-Tech. 61 (1989), Nr. 2, S. 104-112

G. Kaibel, Chem. Eng. Technol., 10(1987), Nr. 2, S. 92-98

H.J. Lang, Chem. Eng. 54(10),117, 1947

H.J. Lang, Chem. Eng. 55(6), 112, 1948

F. Lestak, C. Collins, Chemical Engineering, July 1997, S. 72-76

Course L0096: Process and Plant Engineering I	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Course work	none
Lecturer	Prof. Georg Fieg
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L1214: Process and Plant Engineering I	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Course work	none
Lecturer	Prof. Georg Fieg
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Courses		
Title	Typ Hrs/wk	CP
Introduction to Management (L0880)	Lecture 3	3
Project Entrepreneurship (L0882)	Problem-based Learning 2	3
Module Responsible		
Admission Requirements		
Recommended Previous Knowledge		
Educational Objectives		
Professional Competence		
Knowledge		Planning and Organisation
Skills	 explain the differences between Economics and Management and the sub-disciplines in Management and to name field of Management explain the most important aspects of and goals in Management and name the most important aspects of entreprneu describe and explain basic business functions as production, procurement and sourcing, supply chain management ressource management, information management, innovation management and marketing explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives is some basic methods from mathematical Finance state basics from accounting and costing and selected controlling methods. Students are able to analyse business units with respect to different criteria (organization, objectives, strategies Entrepreneurship project in a team. In particular, they are able to analyse Management goals and structure them appropriately analyse organisational and staff structures of companies apply methods for decision making under multiple objectives, under uncertainty and under risk analyse production and procurement systems and Business information systems analyse and apply basic methods of marketing select and apply basic methods from mathematical finance to predefined problems apply basic methods from accounting, costing and controlling to predefined problems 	rial projects ent, organization and hum and uncertainty, and expl
Personal Competence Social Competence		
Autonomy	Students are able to work in a team and to organize the team themselves to write a report on their project.	
Workload in Hours	s Independent Study Time 110, Study Time in Lecture 70	
Credit points		
Examination		
Examination duration and scale		
Assignment for the Following		
Curricula		
Odinodia	General Engineering Science (German program): Specialisation Process Engineering: Compulsory	
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory	
	General Engineering Science (German program): Specialisation Energy and Environmental Engineering: Compulsory	
	General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory	
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory	
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compu	ılsorv
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics:	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia	
	Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic	cal Mechanical Engineeri
		ooamoar Engineen



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

inpulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

 $General\ Engineering\ Science\ (English\ program):\ Specialisation\ Bioprocess\ Engineering:\ Compulsory$

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program): Specialisation Process Engineering: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Electrical\ Engineering:\ Compulsory$

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Process\ Engineering:\ Compulsory$

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Biomedical\ Engineering:\ Compulsory$

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

 $Logistics\ and\ Mobility: Core\ qualification:\ Compulsory$

 $\label{thm:mechanical engineering: Core qualification: Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Tun	Lecture	
Typ	3	
Hrs/wk	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga	
Lammina	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona DE	
Language	WiSe/SoSe	
Cycle	WISE/SOSE	
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects 	
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008	
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003	
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.	
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.	
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.	
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.	
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.	

Course L0882: Project Entrepreneurship		
Тур	Problem-based Learning	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke	
Language	DE	
Cycle	WiSe/SoSe	
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,	
	using their knowledge from the corresponding lecture.	
	Project work is carried out in teams with the support of a mentor.	
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.	



Specialization Computer Science

The specialization in "Computer Science" consists of core courses in fundamentals of mathematics and computer science, and specialized courses in software or hardware.

Module M0561: Discrete Al	gebraic Structures			
Courses				
Title		Тур	Hrs/wk	СР
Discrete Algebraic Structures (L0164)		Lecture	2	3
Discrete Algebraic Structures (L0165)		Recitation Section (small)	2	3
Module Responsible	Prof. Karl-Heinz Zimmermann			
Admission Requirements	None.			
Recommended Previous	Mathematics from High School.			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fo	ollowing learning results		
Professional Competence				
Knowledge	The students know the important basics of discrete algel	braic structures including elementary combination	atorial structures, mono	ids, groups, rings, fields
	finite fields, and vector spaces. They also know specific str	ructures like sub sum-, and quotient structure	s and homomorphisms.	
Skills	Students are able to formalize and analyze basic discrete algebraic structures.			
Personal Competence				
Social Competence	Students are able to solve specific problems alone or in a	group and to present the results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific	standard books and to associate the acquired	knowledge to other cla	sses.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Special	isation Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semes	ter): Specialisation Computer Science: Compu	Ilsory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Speciali	sation Computer Science: Compulsory		
	General Engineering Science (English program, 7 semest	er): Specialisation Computer Science: Compu	Isory	
	Computational Science and Engineering: Core qualification	on: Compulsory		
	Technomathematics: Specialisation I. Mathematics: Elective	ve Compulsory		

Course L0164: Discrete Algebraic Structures	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Karl-Heinz Zimmermann
Language	DE
Cycle	WiSe
Content	
Literature	

Course L0165: Discrete Algebraic Structures	
Тур	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Karl-Heinz Zimmermann
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses				
Title		Тур	Hrs/wk	CP
Computer Engineering (L0321) Computer Engineering (L0324)		ecture Recitation Section (small)	3 1	4
Module Responsible	Prof. Heiko Falk	recitation decitor (smail)		L
Admission Requirements	None			
Recommended Previous	Basic knowledge in electrical engineering			
Knowledge				
	The successful completion of the labs will be honored during the evaluation of	f the module's examination ac	ccording to the followi	ng rules:
	Upon a passed module examination, the student is granted a bon	us on the examination's mar	rks due to the succe	ssful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the nex	t-better grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not	possible.		
Educational Objectives	After taking part successfully, students have reached the following learning re	sults		
Professional Competence	This is along part coolsessing, seeds in the reading realing re	00110		
Knowledge	This module deals with the foundations of the functionality of computing sy	stems. It covers the lavers fro	om the assembly-leve	el programming down
	gates. The module includes the following topics:		,,	p g g
	Introduction			
	Combinational logic: Gates, Boolean algebra, Boolean functions, hard	lware synthesis, combinationa	al networks	
	Sequential logic: Flip-flops, automata, systematic hardware design Tachnelogical foundations			
	Technological foundations Computer arithmetic: Integer addition, subtraction, multiplication and computer arithmetic.	livision		
	Basics of computer architecture: Programming models, MIPS single-cy			
	Memories: Memory hierarchies, SRAM, DRAM, caches	,		
	 Input/output: I/O from the perspective of the CPU, principles of passing 	data, point-to-point connection	ons, busses	
Skills	The students perceive computer systems from the architect's perspective,			
	computer systems. The students can analyze, how highly specific and inc			
	components. They are able to distinguish between and to explain the differe	nt abstraction layers of today:	s computing systems	- from gates and circl
	up to complete processors.			
	After successful completion of the module, the students are able to judge the	interdependencies between	a physical computer	system and the softwa
	executed on it. In particular, they shall understand the consequences that the	e execution of software has or	n the hardware-centri	c abstraction layers fr
	the assembly language down to gates. This way, they will be enabled to eval	uate the impact that these low	abstraction levels ha	ave on an entire syste
	performance and to propose feasible options.			
Personal Competence				
Social Competence	Students are able to solve similar problems alone or in a group and to preser	t the results accordingly		
oodar oompeterioo	State in a dole to solve similar problems alone of in a group and to presen	t the results decordingly.		
Autonomy	Students are able to acquire new knowledge from specific literature and to as	sociate this knowledge with of	ther classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes, contents of course and labs			
Assignment for the Following	General Engineering Science (German program): Core qualification: Comput	sory		
Curricula	General Engineering Science (German program, 7 semester): Specialisation	Computer Science: Compulso	ory	
	General Engineering Science (German program, 7 semester): Specialisation	Bioprocess Engineering: Com	npulsory	
	General Engineering Science (German program, 7 semester): Specialisation	Naval Architecture: Compulso	ory	
	General Engineering Science (German program, 7 semester): Specialisation	Civil Engineering: Compulsor	у	
	General Engineering Science (German program, 7 semester): Specialisation	Electrical Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester): Specialisation	Biomedical Engineering: Com	npulsory	
	General Engineering Science (German program, 7 semester): Specialisation	Energy and Environmental Eng	gineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Specialisation		•	
	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Specialisation		•	
	General Engineering Science (German program, 7 semester): Specialisa	uon mechanical Engineering	ı, ⊢ocus Materials in	Engineering Science
	Compulación			
	Compulsory General Engineering Science (German program 7 semester): Specialisation	on Machanical Engineering	Focus Theoretical N	Apphanical Enginess
	General Engineering Science (German program, 7 semester): Specialisati	on Mechanical Engineering,	Focus Theoretical M	Mechanical Engineeri
	General Engineering Science (German program, 7 semester): Specialisat Compulsory			,
	General Engineering Science (German program, 7 semester): Specialisat Compulsory General Engineering Science (German program, 7 semester): Specialisation			,
	General Engineering Science (German program, 7 semester): Specialisate Compulsory General Engineering Science (German program, 7 semester): Specialisate Compulsory	on Mechanical Engineering, I	Focus Product Devel	opment and Production
	General Engineering Science (German program, 7 semester): Specialisat Compulsory General Engineering Science (German program, 7 semester): Specialisation	on Mechanical Engineering, I	Focus Product Devel	opment and Producti
	General Engineering Science (German program, 7 semester): Specialisatic Compulsory General Engineering Science (German program, 7 semester): Specialisatic Compulsory General Engineering Science (German program, 7 semester): Specialisation	on Mechanical Engineering, I	Focus Product Devel	opment and Producti
	General Engineering Science (German program, 7 semester): Specialisatic Compulsory General Engineering Science (German program, 7 semester): Specialisatic Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Core qualification: Compulsory	on Mechanical Engineering, f	Focus Product Devel	opment and Producti
	General Engineering Science (German program, 7 semester): Specialisatic Compulsory General Engineering Science (German program, 7 semester): Specialisatic Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory	on Mechanical Engineering, focusions	Focus Product Devel us Energy Systems: 0	opment and Producti
	General Engineering Science (German program, 7 semester): Specialisatic Compulsory General Engineering Science (German program, 7 semester): Specialisatic Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory	on Mechanical Engineering, for Mechanical Engineering, Focusory Computer Science: Compulso	Focus Product Devel us Energy Systems: 0	opment and Producti
	General Engineering Science (German program, 7 semester): Specialisatic Compulsory General Engineering Science (German program, 7 semester): Specialisatic Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation of	on Mechanical Engineering, for Mechanical Engineering, Focusiony Computer Science: Compulso Bioprocess Engineering: Com	Focus Product Devel us Energy Systems: 0 ry pulsory	opment and Producti
	General Engineering Science (German program, 7 semester): Specialisation of Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of Gen	on Mechanical Engineering, for Mechanical Engineering, Fociony Computer Science: Compulso Bioprocess Engineering: Com	Focus Product Devel us Energy Systems: C ry pulsory ry	opment and Producti
	General Engineering Science (German program, 7 semester): Specialisation of Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of General Engineering Science (English program, 7 semester): Specialisation of Gen	on Mechanical Engineering, Foc Mechanical Engineering, Foc Sory Computer Science: Compulso Bioprocess Engineering: Com Naval Architecture: Compulsor Civil Engineering: Compulsor	Focus Product Devel us Energy Systems: C ry pulsory ry	opment and Production

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Computational Science and Engineering: Core qualification: Compulsory
Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	ng
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	Introduction Combinational Logic Sequential Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005.

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



ourses				
tle		Тур	Hrs/wk	CP
Objectoriented Programming, Algorithms and Data Structures (L0131)		Lecture	4	4
bjectoriented Programming, Algorithms a	and Data Structures (L0132)	Recitation Section (small)	1	2
Module Responsible	Prof. Rolf-Rainer Grigat			
Admission Requirements	None			
Recommended Previous	Lecture Prozedurale Programmierung or equivale	nt proficiency in imperative programming		
Knowledge	Mandatory prerequisite for this lecture is proficien	cy in imperative programming (C, Pascal, Fortran or s	imilar) You should be	familiar with simple
		for, while, procedure calls or function calls, pointers, a		
		editor, compiler, linker and debugger. In this lecture v		
	objects and we will not repeat the basics mentione	ed above.		
		LUM because those prerequisites are not part of the c		
	those curricula in general. The programs E1, C1 an	nd IIW include those prerequisites in the first semester i	n the lecture Prozedur	ale Programmierung.
=				
Educational Objectives	After taking part successfully, students have reach	ed the following learning results		
Professional Competence				
Knowledge	·	design and the design of a class architecture with r	eference to existing c	lass libraries and de
	patterns.			
	Students can describe fundamental data structures	s of discrete mathematics and assess the complexity of	important algorithms f	or sorting and searchi
Skills	Students are able to			
	Design coffware using given design patters	ns and applying class hierarchies and polymorphism		
		using version management systems and Google Test		
	Sort and search for data efficiently	somg voluion management of other and deegle volu		
	Assess the complexity of algorithms.			
Personal Competence				
Social Competence	Students can work in teams and communicate in fo	orums.		
Autonomy	Students are able to solve programming tasks suc	ch as LZW data compression using SVN Repository an	d Google Test indepe	ndently and over a pe
	of two to three weeks.			
Workload in Hours	Independent Study Time 110, Study Time in Lectur	re 70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 Minutes, Content of Lecture, exercises and mat	erial in StudIP		
Assignment for the Following	General Engineering Science (German program):	Specialisation Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7	7 semester): Specialisation Computer Science: Compu	Isory	
	Computer Science: Core qualification: Compulsory	y		
	Electrical Engineering: Core qualification: Compul	sory		
	General Engineering Science (English program): 9	Specialisation Computer Science: Compulsory		
		semester): Specialisation Computer Science: Computer	sory	
	Computational Science and Engineering: Core qu			
	Logistics and Mobility: Specialisation Engineering	· · ·		
	Technomathematics: Core qualification: Compulso	ory		



Course L0131: Objectoriented Programming, Algorithms and Data Structures		
Тур	Lecture	
Hrs/wk	4	
CP	4	
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56	
Lecturer	Prof. Rolf-Rainer Grigat	
Language	DE	
Cycle	SoSe	
Content	Object oriented analysis and design:	
	 Objectoriented programming in C++ and Java generic programming UML design patterns Data structures and algorithmes: complexity of algorithms searching, sorting, hash tables, stack, queues, lists, trees (AVL, heap, 2-3-4, Trie, Huffman, Patricia, B), sets, priority queues, directed and undirected graphs (spanning trees, shortest and longest path) 	
Literature	Skriptum	

Course L0132: Objectoriented Prog	Course L0132: Objectoriented Programming, Algorithms and Data Structures		
Тур	Recitation Section (small)		
Hrs/wk	1		
CP	2		
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14		
Lecturer	Prof. Rolf-Rainer Grigat		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		



ourses				
tle		Тур	Hrs/wk	CP
gnals and Systems (L0432)		Lecture	3	4
gnals and Systems (L0433)		Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch			
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge	The modul is an introduction to the theory of signals and sys	stems. Good knowledge in maths as covere	d by the moduls Mat	hematik 1-3 is expe
	Further experience with spectral transformations (Fourier serie	· ·	•	•
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and line			
	to apply the fundamental transformations of continuous-time a			
	and systems mathematically in both time and image domain		in time domain and i	mage domain which
	caused by the transition of a continuous-time signal to a discre			
Skills	The students are able to describe and analyse deterministic s	•	-	
	can analyse and design basic systems regarding important pr		ponse, stability, linear	rity etc They can as
Davidanal Commissioner	the impact of LTI systems on the signal properties in time and f	requency domain.		
Personal Competence	The state of the s			
Social Competence	The students are able to acquire relevant information from a	porapriata literatura sources Theorem	rol their level of low	rladge during the let
Autonomy	The students are able to acquire relevant information from apperiod by solving tutorial problems, software tools, clicker systems.		IOI ITIEIT IEVEI OT KNOW	vieage auring the lea
Waydaad in Harra		9111.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation		mpulsory	
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester):		ulsory	
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):			mpulsory
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semest			
	Compulsory	, ,		0 0
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, Foo	cus Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semeste	er): Specialisation Mechanical Engineering	, Focus Theoretical I	Mechanical Enginee
	Compulsory			-
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation	n Civil- and Enviromental Engeneering: Cor	mpulsory	
	General Engineering Science (English program): Specialisation	n Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation	n Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester):		-	
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester): General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester): General Engineering Science (English program, 7 semester):			mpulsory
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester).			
	Compulsory		,,	gcoming cole
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering Foo	us Mechatronics: Con	npulsory
	General Engineering Science (English program, 7 semester).			
	Compulsory			
	Compulsory Computational Science and Engineering: Core qualification: C	compulsory		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	S
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	Basic classification and description of continuous-time and discrete-time signals and systems
	Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT) Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

Course L0433: Signals and Systems	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0852: Graph Theo	ory and Optimization			
Courses				
Title Graph Theory and Optimization (L1046) Graph Theory and Optimization (L1047)		Typ Lecture Recitation Section (small)	Hrs/wk 2 2	CP 3 3
Module Responsible	Prof. Anusch Taraz	Heditation dection (Smail)	2	3
Admission Requirements	none			
Recommended Previous	none			
Knowledge	Discrete Algebraic Structures Mathematics I			
Educational Objectives	After taking part successfully, students have reached the followin	g learning results		
Professional Competence Knowledge	Students can name the basic concepts in Graph Theory a Students can discuss logical connections between these They know proof strategies and can reproduce them.			
Skills	Students can model problems in Graph Theory and Optir of solving them by applying established methods. Students are able to discover and verify further logical core. For a given problem, the students can develop and execu	nnections between the concepts studied	in the course.	
Personal Competence Social Competence	Students are able to work together in teams. They are cap In doing so, they can communicate new concepts according check and deepen the understanding of their peers.			can design examples to
Autonomy	Students are capable of checking their understanding of where to get help in solving them. Students have developed sufficient persistence to be able.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program, 7 semester): Sp	ecialisation Computer Science: Compul	sory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): Sp		sory	
	Computational Science and Engineering: Core qualification: Cor			
	Logistics and Mobility: Specialisation Engineering Science: Elect Technomathematics: Specialisation I. Mathematics: Elective Com	• •		
	roomomatiiomatios. opedialisation i. Mathematics. Liective Con	puloury		



Course L1046: Graph Theory and O	ptimization
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Anusch Taraz
Language	DE
Cycle	SoSe
Content	Graphs, search algorithms for graphs, trees planar graphs shortest paths minimum spanning trees maximum flow and minimum cut theorems of Menger, König-Egervary, Hall NP-complete problems backtracking and heuristics linear programming duality integer linear programming
Literature	 M. Aigner: Diskrete Mathematik, Vieweg, 2004 J. Matousek und J. Nesetril: Diskrete Mathematik, Springer, 2007 A. Steger: Diskrete Strukturen (Band 1), Springer, 2001 A. Taraz: Diskrete Mathematik, Birkhäuser, 2012 V. Turau: Algorithmische Graphentheorie, Oldenbourg, 2009 KH. Zimmermann: Diskrete Mathematik, BoD, 2006

Course L1047: Graph Theory and O	Course L1047: Graph Theory and Optimization		
Тур	Recitation Section (small)		
Hrs/wk	2		
СР	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Anusch Taraz		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		



Module M0727: Stochastics	S			
Courses				
Title		Тур	Hrs/wk	CP
Stochastics (L0777)		Lecture	2	4
Stochastics (L0778)		Recitation Section (small)	2	2
Module Responsible	Prof. Marko Lindner			
Admission Requirements	none			
Recommended Previous	Calculus			
Knowledge	Discrete algebraic structures (combinatorics)			
	Propositional logic			
	- Propositional rogio			
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge				
	dependence, independence assumptions) used in discrete and			
	describe characteristic notions such as expected values, varia			
	explain algorithms for solving these problems (based on the cl			•
	analyzed in terms of notions such as bias of an estimator, etc. S		•	
Skills	solving decision and computation problem for stochastic process			
Skills	Students can apply algorithms for solving decision problems, application contexts, i.e., students can derive estimators and judg			good enough in various
	application contexts, i.e., students can derive estimators and judg	e whether they are applicable of reliab		
Personal Competence				
Social Competence	- Students are able to work together (e.g. on their regular home w	ork) in heterogeneously composed tea	ms (i.e., teams from diffe	erent study programs and
	background knowledge) and to present their results appropriatel	y (e.g. during exercise class).		
Autonomy	- Students are capable of checking their understanding of comple	x concepts on their own. They can spe	cify open questions pre	cisely and know where to
,	get help in solving them.	, , , , , , , , , , , , , , , , , , , ,	, , , ,	•
	- Students can put their knowledge in relation to the contents of o	ther lectures.		
	- Students have developed sufficient persistence to be able to wo	rk for longer periods in a goal-oriented	manner on hard proble	ms.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Sp	ecialisation Computer Science: Compu	Ilsory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation (
	General Engineering Science (English program, 7 semester): Spo	·	Isory	
	Computational Science and Engineering: Core qualification: Con	•		
	Logistics and Mobility: Specialisation Engineering Science: Elect	ve Compulsory		



Course L0777: Stochastics	
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Dr. Francisco Javier Hoecker-Escuti
Language	EN
Cycle	SoSe
Content	Foundations of probability theory
	Definitions of probability, conditional probability
	Random variables, dependencies, independence assumptions,
	Marginal and joint probabilities
	Distributions and density functions
	Characteristics: expected values, variance, standard deviation, moments
	Practical representations for joint probabilities
	Bayessche Netzwerke
	Semantik, Entscheidungsprobleme, exakte und approximative Algorithmen
	Stochastic processes
	Stationarity, ergodicity
	• Correlations
	Dynamic Bayesian networks, Hidden Markov networks, Kalman filters, queues
	Detection & estimation
	• Detectors
	Estimation rules and procedures
	Hypothesis and distribution tests
	Stochastic regression
Literature	Methoden der statistischen Inferenz, Likelihood und Bayes, Held, L., Spektrum 2008
	2. Stochastik für Informatiker, Dümbgen, L., Springer 2003
	3. Statistik: Der Weg zur Datenanalyse, Fahrmeir, L., Künstler R., Pigeot, I, Tutz, G., Springer 2010
	4. Stochastik, Georgii, HO., deGruyter, 2009
	5. Probability and Random Processes, Grimmett, G., Stirzaker, D., Oxford University Press, 2001
	6. Programmieren mit R, Ligges, U., Springer 2008

Course L0778: Stochastics	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Francisco Javier Hoecker-Escuti
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0624: Automata	Theory and Formal Languages			
Courses				
Title		Тур	Hrs/wk	CP
Automata Theory and Formal Languages	(L0332)	Lecture	2	4
Automata Theory and Formal Languages		Recitation Section (small)	2	2
Module Responsible	Prof. Tobias Knopp			
Admission Requirements	None			
Recommended Previous	Participating students should be able to			
Knowledge	- specify algorithms for simple data structures (such as, e.g., ar	rays) to solve computational problems		
	- apply propositional logic and predicate logic for specifying ar	nd understanding mathematical proofs		
	- apply the knowledge and skills taught in the module Discrete	Algebraic Structures		
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results		
Professional Competence				
	Students can show correspondences to Boolean algebra. Sti logic, and therefore, the students can motivate predicate logic Students can explain unification and resolution for solving the decision problems for various kinds of temporal logic, and ider automata and can identify relationships to logic and form nondeterministic finite automata and pushdown automata to expressive than determinism. They are also able to demons transform decision problems w.r.t. one formalism into decisio algorithms whereas others are best suited for specifying syste as logic, automata, or grammars.	c, and define syntax, semantics, and decisi predicate logic SAT decision problem. Stuc ntify their application areas. The participants al grammars. The spectrum that students Turing machines. Students can name those trate which decision problems require which problems w.r.t. other formalisms. They up	on problems for this re- dents can also describe s of the course can defi- can explain ranges e formalism for which in the expressivity, and, in inderstand that some for	epresentation formalism e syntax, semantics, and ne various kinds of finite from deterministic and nondeterminism is more n addition, students car ormalisms easily induce
Skills	Students can apply propositional logic as well as predicate logic derive propositional logic, predicate logic, or temporal logic for application problem, and they can demonstrate the application nondeterministic automata into deterministic ones, or derive gapply algorithms for the language emptiness problem in case of	rmulas to represent them. They can evaluate on of algorithms for decision problems to s grammars from automata and vice versa. Th	e which formalism is be specific formulas. Stud	est suited for a particula ents can also transform
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	on Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semester):	Specialisation Computer Science: Elective	Compulsory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation	n Computer Science: Compulsory		
	General Engineering Science (English program, 7 semester):	Specialisation Computer Science: Elective C	Compulsory	
	Computational Science and Engineering: Core qualification: C			
	Technomathematics: Specialisation II. Informatics: Elective Co.	mpulsory		



Course L0332: Automata Theory an	
	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Tobias Knopp
Language	EN
Cycle	SoSe
Content	1. Drangational logic Region algebra propositional regulation CAT OVNIE
	Propositional logic, Boolean algebra, propositional resolution, SAT-2KNF Predicate logic, unification, predicate logic resolution
	Temporal Logics (LTL, CTL)
	Deterministic finite automata, definition and construction
	Beterministic limite automata, definition and constitution Regular languages, closure properties, word problem, string matching
	6. Nondeterministic automata:
	Rabin-Scott transformation of nondeterministic into deterministic automata
	7. Epsilon automata, minimization of automata,
	elimination of e-edges, uniqueness of the minimal automaton (modulo renaming of states)
	8. Myhill-Nerode Theorem:
	Correctness of the minimization procedure, equivalence classes of strings induced by automata
	9. Pumping Lemma for regular languages:
	provision of a tool which, in some cases, can be used to show that a finite automaton principally cannot be expressive enough to solve a word
	problem for some given language
	10. Regular expressions vs. finite automata:
	Equivalence of formalisms, systematic transformation of representations, reductions
	11. Pushdown automata and context-free grammars:
	Definition of pushdown automata, definition of context-free grammars, derivations, parse trees, ambiguities, pumping lemma for context-free
	grammars, transformation of formalisms (from pushdown automata to context-free grammars and back)
	12. Chomsky normal form
	13. CYK algorithm for deciding the word problem for context-free grammrs
	14. Deterministic pushdown automata
	15. Deterministic vs. nondeterministic pushdown automata:
	Application for parsing, LL(k) or LR(k) grammars and parsers vs. deterministic pushdown automata, compiler compiler
	16. Regular grammars
	17. Outlook: Turing machines and linear bounded automata vs general and context-sensitive grammars
	18. Chomsky hierarchy
	19. Mealy- and Moore automata:
	Automata with output (w/o accepting states), infinite state sequences, automata networks
	20. Omega automata: Automata for infinite input words, Büchi automata, representation of state transition systems, verification w.r.t. temporal logic
	specifications (in particular LTL)
	21. LTL safety conditions and model checking with Büchi automata, relationships between automata and logic
	22. Fixed points, propositional mu-calculus
	23. Characterization of regular languages by monadic second-order logic (MSO)
Literature	
	1. Logik für Informatiker Uwe Schöning, Spektrum, 5. Aufl.
	2. Logik für Informatiker Martin Kreuzer, Stefan Kühling, Pearson Studium, 2006
	3. Grundkurs Theoretische Informatik, Gottfried Vossen, Kurt-Ulrich Witt, Vieweg-Verlag, 2010.
	4. Principles of Model Checking, Christel Baier, Joost-Pieter Katoen, The MIT Press, 2007

Course L0507: Automata Theory and Formal Languages	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Tobias Knopp
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0803: Embedded	Systems			
Courses				
Title		Тур	Hrs/wk	СР
Embedded Systems (L0805)		Lecture	3	4
Embedded Systems (L0806)		Recitation Section (small)	1	2
Module Responsible	Prof. Heiko Falk			
Admission Requirements	None			
Recommended Previous	Computer Engineering			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	Embedded systems can be defined as information processing sys	tems embedded into enclosing produc	ts. This course teaches	s the foundations of such
	systems. In particular, it deals with an introduction into these sys	tems (notions, common characteristics	and their specification	on languages (models of
	computation, hierarchical automata, specification of distributed	systems, task graphs, specification of	f real-time application	ns, translations between
	different models).			
	Another part covers the hardware of embedded systems: Sonso	rs A/D and D/A converters real-time	canable communication	on hardware embedded
	processors, memories, energy dissipation, reconfigurable logic an			
	middleware and real-time scheduling. Finally, the implementa			
	partitioning, high-level transformations of specifications, energy-ef	,		• .
Skills	After having attended the course, students shall be able to rea			
	technological competences to use in order to obtain a functional		•	•
	computations and feasible techniques for system-level design. T	ney shall be able to judge in which ar	eas of embedded syst	tem design specific risks
Personal Competence	exist.			
l	Students are able to calve similar problems alone or in a group an	d to present the regulte accordingly		
Social Competence	Students are able to solve similar problems alone or in a group an	d to present the results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific literatur	e and to associate this knowledge with	other classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes, contents of course and labs			
Assignment for the Following	General Engineering Science (German program, 7 semester): Spe	cialisation Computer Science: Elective	Compulsory	
Curricula	Computer Science: Specialisation Computer and Software Engine	ering: Elective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program, 7 semester): Spe	cialisation Computer Science: Elective	Compulsory	
	Computational Science and Engineering: Core qualification: Com	oulsory		
	Mechatronics: Specialisation System Design: Elective Compulsory			
	Mechatronics: Specialisation Intelligent Systems and Robotics: Ele	ective Compulsory		

Course L0805: Embedded Systems	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Heiko Falk
Language	EN
Cycle	SoSe
Content	 Introduction Specifications and Modeling Embedded/Cyber-Physical Systems Hardware System Software Evaluation and Validation Mapping of Applications to Execution Platforms Optimization
Literature	 Peter Marwedel. Embedded System Design - Embedded Systems Foundations of Cyber-Physical Systems. 2nd Edition, Springer, 2012., Springer, 2012.



Course L0806: Embedded Systems	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



ourses				
tle		Тур	Hrs/wk	CP
umerical Mathematics I (L0417)		Lecture	2	3
umerical Mathematics I (L0418)	Durf Cabina La Davina	Recitation Section (small)	2	3
Module Responsible	Prof. Sabine Le Borne			
Admission Requirements Recommended Previous	None			
Knowledge	Mathematik I + II for Engineering Students (german or engine basic MATLAB knowledge	ılish) or Analysis & Linear Algebra I + II for	Technomathematici	ans
Educational Objectives	After taking part successfully, students have reached the followin	g learning results		
Professional Competence				
Knowledge	Students are able to			
	 name numerical methods for interpolation, integration, explain their core ideas, repeat convergence statements for the numerical method explain aspects for the practical execution of numerical method 	s,		finding problems and
Skills	Students are able to			
	 implement, apply and compare numerical methods using justify the convergence behaviour of numerical methods 		gorithm,	
	 select and execute a suitable solution approach for a give 		,	
Personal Competence				
Social Competence	Students are able to			
	work together in heterogeneously composed teams (i.e.	teams from different study programs and	d background knowle	edge), explain theoret
	foundations and support each other with practical aspects	regarding the implementation of algorithm	ns.	
Autonomy	Studente are canable			
Autonomy	Students are capable			
	 to assess whether the supporting theoretical and practical 	excercises are better solved individually	or in a team,	
	 to assess their individual progess and, if necessary, to as 	questions and seek help.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation	Computer Science: Compulsory		
Curricula	General Engineering Science (German program): Specialisation		anics: Compulsory	
	General Engineering Science (German program): Specialisation			nces: Compulsory
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): Sp	ecialisation Computer Science: Compulso	ory	
	General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering	, Focus Materials i	n Engineering Science
	Compulsory			
	General Engineering Science (German program, 7 semester): Sp	ecialisation Biomedical Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering, Foo	us Biomechanics: Co	ompulsory
	Bioprocess Engineering: Specialisation A - General Bioprocess	0 0 ,		
	Computer Science: Specialisation Computational Mathematics: E	Elective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation		unios: Compulsor:	
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation			nces: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation		-	ioca. Gonipuistry
	General Engineering Science (English program, 7 semester). Sp.	·	-	n Engineering Science
	Compulsory	- Sposiandation Modifical Linguisting	, . Jour Materials I	. Linginiconning Golding
	General Engineering Science (English program, 7 semester): Sp	ecialisation Biomedical Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester): Sp	• •		mpulsory
	Computational Science and Engineering: Core qualification: Cor			· •



Course L0417: Numerical Mathema	tics I	
Тур	Lecture	
Hrs/wk		
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Sabine Le Borne, Dr. Patricio Farrell	
Language	DE/EN	
Cycle	WiSe	
Content	 Error analysis: Number representation, error types, conditioning and stability Interpolation: polynomial and spline interpolation Numerical integration and differentiation: order, Newton-Cotes formula, error estimates, Gaussian quadrature, adaptive quadrature, difference formulas Linear systems: LU and Cholesky factorization, matrix norms, conditioning Linear least squares problems: normal equations, Gram.Schmidt and Householder orthogonalization, singular value decomposition, regularization Eigenvalue problems: power iteration, inverse iteration, QR algorithm Nonlinear systems of equations: Fixed point iteration, root-finding algorithms for real-valued functions, Newton and Quasi-Newton methods for systems 	
Literature	Stoer/Bulirsch: Numerische Mathematik 1, Springer Dahmen, Reusken: Numerik für Ingenieure und Naturwissenschaftler, Springer	

Course L0418: Numerical Mathema	course L0418: Numerical Mathematics I	
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Sabine Le Borne, Dr. Patricio Farrell	
Language	DE/EN	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0793: Seminars C	computer Science and Mathematics			
Courses				
Title		Тур	Hrs/wk	СР
Seminar Computational Mathematics/Com	puter Science (L0797)	Seminar	2	2
Seminar Computational Engineering Scien	ce (L0796)	Seminar	2	2
Seminar Engineering Mathematics/Compu	ter Science (L1781)	Seminar	2	2
Module Responsible	Prof. Karl-Heinz Zimmermann			
Admission Requirements	None			
Recommended Previous	Basic knowledge in Computer Science, Mathematics	s, and eventually Engineering Science.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge	The students know who to acquire basic knowledge in a rudimentary field of Computer Science, Mathematics, or Engineering Science.			
Skills	The students are able to elaborate self-reliantly a rudimentary subfield of Computer Science, Mathematics, or Engineering Science.			
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Presentation			
Examination duration and scale	Pro Seminar erfolgt der Scheinerwerb durch Präsentation (Seminarvortrag 25 min und Diskussion 5 min)			
Assignment for the Following	General Engineering Science (German program): Specialisation Computer Science: Compulsory			
Curricula	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory			
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Sp	ecialisation Computer Science: Compulsory		
	General Engineering Science (English program, 7 se	emester): Specialisation Computer Science: Con	npulsory	
	Computational Science and Engineering: Core qual	ification: Compulsory		

Course L0797: Seminar Computational Mathematics/Computer Science		
Jourse L0797: Seminar Computational Mathematics/Computer Science		
Тур	Seminar	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Karl-Heinz Zimmermann, Dr. Jens-Peter Zemke	
Language	DE/EN	
Cycle	WiSe/SoSe	
Content	 Seminar presentations by enrolled students. Seminar topics from the field of computer-oriented mathematics or computer science are proposed by the organizer Active participation in discussions. 	
Literature	Wird vom Seminarveranstalter bekanntgegeben.	

Course L0796: Seminar Computational Engineering Science		
Тур	Seminar	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Karl-Heinz Zimmermann	
Language	DE/EN	
Cycle	WiSe/SoSe	
Content	 Seminar presentations by enrolled students. Seminar topics from the field of computer science or engineering science are proposed by the organizer Active participation in discussions. 	
Literature	Wird vom Seminarveranstalter bekanntgegeben.	



Course L1781: Seminar Engineering	Mathematics/Computer Science
Тур	Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Karl-Heinz Zimmermann, Dr. Jens-Peter Zemke
Language	DE/EN
Cycle	WiSe/SoSe
Content	 Seminar presentations by enrolled students. Seminar topics from the field of computer science or engineering mathematics are proposed by the organizer Active participation in discussions.
Literature	Wird vom Seminarveranstalter bekanntgegeben.



Module M0834: Computern	etworks and Internet Security			
Courses				
Title		Тур	Hrs/wk	СР
Computer Networks and Internet Security	(L1098)	Lecture	3	5
Computer Networks and Internet Security	(L1099)	Recitation Section (small)	1	1
Module Responsible	Prof. Andreas Timm-Giel			
Admission Requirements	None			
Recommended Previous	Basics of Computer Science			
Knowledge				
Educational Objectives	After taking part successfully, students have reached	d the following learning results		
Professional Competence				
Knowledge	Students are able to explain important and common	n Internet protocols in detail and classify them, in or	der to be able to analyse	e and develop networked
	systems in further studies and job.			
Skills	Students are able to analyse common Internet protocols and evaluate the use of them in different domains.			
Personal Competence				
Social Competence				
Autonomy	Students can select relevant parts out of high amount	nt of professional knowledge and can independently	y learn and understand i	t.
Workload in Hours	Independent Study Time 124, Study Time in Lecture	56		
	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): S		0	
Curricula	General Engineering Science (German program, 7	semester): Specialisation Computer Science: Elective	e Compulsory	
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Elective (
	General Engineering Science (English program): Sp			
	General Engineering Science (English program, 7 s		e Compulsory	
	Computational Science and Engineering: Core qua	·		
	Technomathematics: Specialisation II. Informatics: E Technomathematics: Specialisation II. Informatics: E			
	recimomathematics: Specialisation ii. Informatics: E	nective Compulsory		

Course L1098: Computer Networks	
	Lecture
Hrs/wk	3
СР	5
Workload in Hours	Independent Study Time 108, Study Time in Lecture 42
Lecturer	Prof. Andreas Timm-Giel, Prof. Dieter Gollmann
Language	EN
Cycle	WiSe
Content	In this class an introduction to computer networks with focus on the Internet and its security is given. Basic functionality of complex protocols are introduced. Students learn to understand these and identify common principles. In the exercises these basic principles and an introduction to performance modelling are addressed using computing tasks and (virtual) labs. In the second part of the lecture an introduction to Internet security is given. This class comprises: Application layer protocols (HTTP, FTP, DNS) Transport layer protocols (TCP, UDP) Network Layer (Internet Protocol, routing in the Internet) Data link layer with media access at the example of Ethernet Multimedia applications in the Internet Network management Internet security: IPSec Internet security: Firewalls
Literature	Kurose, Ross, Computer Networking - A Top-Down Approach, 6th Edition, Addison-Wesley Kurose, Ross, Computernetzwerke - Der Top-Down-Ansatz, Pearson Studium; Auflage: 6. Auflage W. Stallings: Cryptography and Network Security: Principles and Practice, 6th edition Further literature is announced at the beginning of the lecture.



Course L1099: Computer Networks and Internet Security	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Andreas Timm-Giel, Prof. Dieter Gollmann
Language	EN
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0731: Functional P				
Courses				
Title		Тур	Hrs/wk	CP
functional Programming (L0624)		Lecture	2	2
Functional Programming (L0625)		Recitation Section (large)	2	2
Functional Programming (L0626)		Recitation Section (small)	2	2
Module Responsible	Prof. Sibylle Schupp			
Admission Requirements	None			
Recommended Previous	Discrete mathematics at high-school level			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the followi	ng learning results		
Professional Competence				
*	Students apply the principles, constructs, and simple design		•	•
'	programs and to explain Haskell syntax as well as Haskell's re			
	fundamental data structures, data types, and type constructors.		ctions and simple pr	oof techniques for partial
	and total correctness. They distinguish laziness from other evaluation strategies.			
Skills 5	Students break a natural-language description down in parts a	amenable to a formal specification and deve	elop a functional prog	ram in a structured way.
-	They assess different language constructs, make conscious s	elections both at specification and implement	entations level, and	justify their choice. They
ŧ	analyze given programs and rewrite them in a controlled way. They design and implement unit tests and can assess the quality of their tests. They argue			
f	for the correctness of their program.			
Personal Competence				
Social Competence	Students practice peer programming with varying peers. They explain problems and solutions to their peer. They defend their programs orally. They			
,	communicate in English.			, ., .,
Autonomy	In programming labs, students learn under supervision (a.k.a.	"Retreutes Programmieren") the mechanic	s of programming In	evercises they develon
*	solutions individually and independently, and receive feedback	· · · · · · · · · · · · · · · · · · ·	o or programming. in	exciologo, they develop
	solutions marviating and macpendently, and receive lecablest	•		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination \	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisatio	n Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): S	Specialisation Computer Science: Elective C	ompulsory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation	n Computer Science: Compulsory		
	General Engineering Science (English program, 7 semester): S	pecialisation Computer Science: Elective Co	ompulsory	
	Computational Science and Engineering: Specialisation Comp	uter Science: Elective Compulsory		
-	Technomathematics: Specialisation II. Informatics: Elective Con	npulsory		

Course L0624: Functional Programm	ning
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Sibylle Schupp
Language	EN
Cycle	WiSe
Content	 Functions, Currying, Recursive Functions, Polymorphic Functions, Higher-Order Functions Conditional Expressions, Guarded Expressions, Pattern Matching, Lambda Expressions Types (simple, composite), Type Classes, Recursive Types, Algebraic Data Type Type Constructors: Tuples, Lists, Trees, Associative Lists (Dictionaries, Maps) Modules Interactive Programming Lazy Evaluation, Call-by-Value, Strictness Design Recipes Testing (axiom-based, invariant-based, against reference implementation) Reasoning about Programs (equation-based, inductive) Idioms of Functional Programming Haskell Syntax and Semantics
Literature	Graham Hutton, Programming in Haskell, Cambridge University Press 2007.



Course L0625: Functional Programming		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Sibylle Schupp	
Language	EN	
Cycle	WiSe	
Content	 Functions, Currying, Recursive Functions, Polymorphic Functions, Higher-Order Functions Conditional Expressions, Guarded Expressions, Pattern Matching, Lambda Expressions Types (simple, composite), Type Classes, Recursive Types, Algebraic Data Type Type Constructors: Tuples, Lists, Trees, Associative Lists (Dictionaries, Maps) Modules Interactive Programming Lazy Evaluation, Call-by-Value, Strictness Design Recipes Testing (axiom-based, invariant-based, against reference implementation) Reasoning about Programs (equation-based, inductive) Idioms of Functional Programming Haskell Syntax and Semantics 	
Literature	Graham Hutton, Programming in Haskell, Cambridge University Press 2007.	

Course L0626: Functional Programming		
Тур	Recitation Section (small)	
Hrs/wk	2	
СР	2	
Workload in Hours	ndependent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Sibylle Schupp	
Language	EN	
Cycle	WiSe	
Content	 Functions, Currying, Recursive Functions, Polymorphic Functions, Higher-Order Functions Conditional Expressions, Guarded Expressions, Pattern Matching, Lambda Expressions Types (simple, composite), Type Classes, Recursive Types, Algebraic Data Type Type Constructors: Tuples, Lists, Trees, Associative Lists (Dictionaries, Maps) Modules Interactive Programming Lazy Evaluation, Call-by-Value, Strictness Design Recipes Testing (axiom-based, invariant-based, against reference implementation) Reasoning about Programs (equation-based, inductive) Idioms of Functional Programming Haskell Syntax and Semantics 	
Literature	Graham Hutton, Programming in Haskell, Cambridge University Press 2007.	



Sule M0791: Computer And Sule M0791: Computer	cmiecture	Тур		
		Typ		
		Typ		
uter Architecture (L0793)			Hrs/wk	CP
		Lecture	nrs/wk 2	3
outer Architecture (L0794)		Problem-based Learning	2	2
uter Architecture (L1864)		Recitation Section (small)	1	1
	Prof. Heiko Falk	rissians. Section (emaily	•	•
Admission Requirements N	lone			
Recommended Previous M	Module "Computer Engineering"			
Knowledge				
Educational Objectives A	after taking part successfully, students have reached the fo	llowing learning results		
Professional Competence				
Knowledge TI	his module presents advanced concepts from the discip	line of computer architecture. In the beginning	, a broad overview ov	rer various programming
m	models is given, both for general-purpose computers and for special-purpose machines (e.g., signal processors). Next, foundational aspects of the			
m	nicro-architecture of processors are covered. Here, the fo	ocus particularly lies on the so-called pipelining	and the methods use	ed for the acceleration of
in	nstruction execution used in this context. The students	get to know concepts for dynamic scheduling	, branch prediction, s	superscalar execution of
m	nachine instructions and for memory hierarchies.			
Skills Ti	he students are able to describe the organization of proce	essors. They know the different architectural prin	ciples and programm	ing models. The students
	xamine various structures of pipelined processor archit	·		-
	erformance or energy efficiency. They evaluate differen	·	•	
i i	istinguish between instruction- and data-level parallelism		and compater around	
Personal Competence				
Social Competence S	students are able to solve similar problems alone or in a g	roup and to present the results accordingly.		
Autonomy S	Students are able to acquire new knowledge from specific	literature and to associate this knowledge with o	other classes.	
Workload in Hours In	ndependent Study Time 110, Study Time in Lecture 70			
Credit points 6				
Examination W	Vritten exam			
xamination duration and scale 9	0 minutes, contents of course and 4 attestations from the	PBL "Computer architecture"		
Assignment for the Following G	General Engineering Science (German program): Speciali	sation Computer Science: Compulsory		
Curricula G	General Engineering Science (German program, 7 semest	er): Specialisation Computer Science: Elective	Compulsory	
С	Computer Science: Specialisation Computer and Software	Engineering: Elective Compulsory		
G	General Engineering Science (English program): Specialis	sation Computer Science: Compulsory		
G	General Engineering Science (English program, 7 semeste	er): Specialisation Computer Science: Elective C	Compulsory	
С	Computational Science and Engineering: Specialisation C	omputer Science: Elective Compulsory		

Course I 0700. Committee & robits at	
Course L0793: Computer Architectu	
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Heiko Falk
Language	DE/EN
Cycle	WiSe
Content	 Introduction VHDL Basics Programming Models Realization of Elementary Data Types Dynamic Scheduling Branch Prediction Superscalar Machines Memory Hierarchies The theoretical tutorials amplify the lecture's content by solving and discussing exercise sheets and thus serve as exam preparation. Practical aspects of computer architecture are taught in the FPGA-based PBL on computer architecture whose attendance is mandatory.
Literature	 D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001.



Course L0794: Computer Architecture	
Тур	Problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Heiko Falk
Language	DE/EN
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L1864: Computer Architecture	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE/EN
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses	
Title	Typ Hrs/wk CP
Introduction to Control Systems (L0654) Introduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2
Module Responsible	
Admission Requirements	
Recommended Previous	
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second or
	systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.
	They can explain the role of the phase margin in analysis and synthesis of control loops
	They can explain the way a PID controller affects a control loop in terms of its frequency response
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally
Skills	
	Students can transform models of linear dynamic systems from time to frequency domain and vice versa
	They can simulate and assess the behavior of systems and control loops They can design RID controllers with the help of heuristic (7iceler Nichele) tuning rules.
	 They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks
Personal Competence	
Social Competence	
Autonomy	Students can obtain information from provided sources (lecture notes, software documentation, experiment guides) and use it when solving give problems.
	problems.
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Workload in Hours Credit points	
	6
Credit points	6 Written exam
Credit points Examination	6 Written exam 120 min
Credit points Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producticompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Genera
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science; Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producticompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (Ger
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems:
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineeri Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Devel
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester):
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Comp
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (Engilish progra
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Avail Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English progra
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (Engilish progra



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

Тур	Lecture	
Hrs/wk	2	
СР	4	
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28	
Lecturer	Prof. Herbert Werner	
Language	DE	
Cycle	WiSe	
Content	Signals and systems	
	Linear systems, differential equations and transfer functions First and accordingly systems, poles and reasoning the property of the	
	 First and second order systems, poles and zeros, impulse and step response Stability 	
	• Stability	
	Feedback systems	
	Principle of feedback, open-loop versus closed-loop control	
	Reference tracking and disturbance rejection	
	Types of feedback, PID control	
	System type and steady-state error, error constants	
	Internal model principle	
	Root locus techniques	
	Root locus plots	
	Root locus design of PID controllers	
	Frequency response techniques	
	Bode diagram	
	Minimum and non-minimum phase systems	
	Nyquist plot, Nyquist stability criterion, phase and gain margin	
	Loop shaping, lead lag compensation	
	Frequency response interpretation of PID control	
	Time delay systems	
	Root locus and frequency response of time delay systems	
	Smith predictor	
	Digital control	
	Sampled-data systems, difference equations	
	Tustin approximation, digital implementation of PID controllers	
	Software tools	
	Introduction to Matlab, Simulink, Control toolbox	
	Computer-based exercises throughout the course	
Literature		
	Werner, H., Lecture Notes "Introduction to Control Systems"	
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009	
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010	
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010	



Course L0655: Introduction to Control Systems	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0562: Computabi	lity and Complexity Theory			
Courses				
Title		Тур	Hrs/wk	CP
Computability and Complexity Theory (L0:	166)	Lecture	2	3
Computability and Complexity Theory (L0:	67)	Recitation Section (small)	2	3
Module Responsible	Prof. Karl-Heinz Zimmermann			
Admission Requirements	None.			
Recommended Previous	Discrete Algebraic Structures, Automata Theory, Logic, and Formal Language Theory.			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	ne following learning results		
Professional Competence				
Knowledge	The students known the important machine models of	computability, the class of partial recursive functi	ons, universal computal	oility, Gödel numbering o
	computations, the theorems of Kleene, Rice, and R	ce-Shapiro, the concept of decidable and unde	ecidable sets, the word	problems for semi-Thue
	systems, Thue systems, semi-groups, and Post corresp	ondence systems, Hilbert's 10-th problem, and the	e basic concepts of con	nplexity theory.
Skills	Students are able to investigate the computability of sets and functions and to analyze the complexity of computable functions.			
Personal Competence				
•	Students are able to solve specific problems alone or in a group and to present the results accordingly.			
,,,,,		3,		
Autonomy	Students are able to acquire new knowledge from new	er literature and to associate the acquired knowle	edge with other classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 5	6		
Credit points	6			
Examination	Oral exam			
Examination duration and scale	20 min			
Assignment for the Following	General Engineering Science (German program, 7 ser	nester): Specialisation Computer Science: Electiv	e Compulsory	
Curricula	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program, 7 ser	nester): Specialisation Computer Science: Electiv	e Compulsory	
	Computational Science and Engineering: Specialisation	on Computer Science: Elective Compulsory		
	Technomathematics: Specialisation II. Informatics: Ele	ctive Compulsory		
1	Technomathematics: Core qualification: Elective Com	pulsory		

Course L0166: Computability and Complexity Theory	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Karl-Heinz Zimmermann
Language	DE/EN
Cycle	SoSe
Content	
Literature	

Course L0167: Computability and Complexity Theory	
Тур	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Karl-Heinz Zimmermann
Language	DE/EN
Cycle	SoSe
Content	
Literature	



courses				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880) roject Entrepreneurship (L0882)		Lecture Problem-based Learning	3	3
Module Responsible	Prof. Christoph Ihl	1 Tobletti-based Learning		3
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of r Marketing and Innovation, and also to Investment and Controlling		nagement, from Plan	ning and Organisation
	explain the differences between Economics and Manager	ment and the sub-disciplines in Managen	nent and to name impo	ortant definitions from t
	field of Management			
	explain the most important aspects of and goals in Manag describe and explain basic business functions as produce.			
	ressource management, information management, innova		Chain management,	organization and num
	explain the relevance of planning and decision making		ultiple objectives and	uncertainty, and expla
	some basic methods from mathematical Finance	•		
	state basics from accounting and costing and selected core	ntrolling methods.		
Skills	Students are able to analyse business units with respect to Entrepreneurship project in a team. In particular, they are able to	to different criteria (organization, obje	ctives, strategies etc	.) and to carry out
	Manager Manage			
	analyse Management goals and structure them appropria analyse organisational and staff structures of companies	tely		
	apply methods for decision making under multiple objective.	ves, under uncertainty and under risk		
	analyse production and procurement systems and Busine			
	analyse and apply basic methods of marketing	•		
	select and apply basic methods from mathematical finance	e to predefined problems		
	apply basic methods from accounting, costing and control	ling to predefined problems		
Personal Competence				
Social Competence	Students are able to			
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entreprene	eurship project and write a coherent repo	t on the project	
	to communicate appropriately and			
	to cooperate respectfully with their fellow students.			
Autonomy	Students are able to			
	work in a team and to organize the team themselves			
	to write a report on their project.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points				
Examination				
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation	Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	Computer Science: Compulsory		
	General Engineering Science (German program): Specialisation	Process Engineering: Compulsory		
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation		ompuisory	
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): Sp	ecialisation Electrical Engineering: Com	oulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp	•	•	
	General Engineering Science (German program, 7 semester): Sp	·	•	
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp	,		
		recialisation Civil Engineering: Compulso recialisation Energy and Enviromental En		v
	General Engineering Science (Gennan Diodrain, 7 Seinesier) 333		5	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering. Fo	cus Mechatronics: Cor	npulsory
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering, Fo	cus Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering, Forecialisation Mechanical Engineering, Forecialisation	cus Biomechanics: Co cus Aircraft Systems E	mpulsory ngineering: Compulso
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory	ecialisation Mechanical Engineering, For ecialisation Mechanical Engineering, For Specialisation Mechanical Engineerin	cus Biomechanics: Co cus Aircraft Systems E g, Focus Materials ir	mpulsory ngineering: Compulso Engineering Science
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester):	ecialisation Mechanical Engineering, For ecialisation Mechanical Engineering, For Specialisation Mechanical Engineerin	cus Biomechanics: Co cus Aircraft Systems E g, Focus Materials ir	mpulsory ngineering: Compulso Engineering Science



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

inpulsory

 $General\ Engineering\ Science\ (German\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Energy\ Systems:\ Compulsory$

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

 $General\ Engineering\ Science\ (English\ program):\ Specialisation\ Biomedical\ Engineering:\ Compulsory$

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program); Specialisation Process Engineering; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Compulsory\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Mechanical\ Engineering,\ M$

General Engineering Science (English program, 7 semester); Specialisation Mechanical Engineering, Focus Biomechanics; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

 $Logistics\ and\ Mobility: Core\ qualification: Compulsory$

 $\label{thm:mechanical engineering: Core qualification: Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

 $\label{thm:compulsory} \textbf{Technomathematics: Core qualification: Compulsory}$

Process Engineering: Core qualification: Compulsory



Turn	Lecture
Typ	3
Hrs/wk	
	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	WIGE/2003e
	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management
	Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.
	Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Course L0882: Project Entrepreneu	rship
Тур	Problem-based Learning
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept, using their knowledge from the corresponding lecture.
	Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Courses				
Title Title	Typ H	lrs/wk	CP	
ab Cyber-Physical Systems (L1740)	Problem-based Learning 4	ļ	6	
Module Responsible	Prof. Heiko Falk			
Admission Requirements	None			
Recommended Previous	Module "Embedded Systems"			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge	Cyber-Physical Systems (CPS) are tightly integrated with their surrounding environment, via sensors, A/D and D/A converters, and actors. Due particular application areas, highly specialized sensors, processors and actors are common. Accordingly, there is a large variety of different special approaches for CPS - in contrast to classical software engineering approaches.			
	Based on practical experiments using robot kits and computers, the basics of specification and modelling of CPS are taught. The lab introduces in area (basic notions, characteristical properties) and their specification techniques (models of computation, hierarchical automata, data flow models nets, imperative approaches). Since CPS frequently perform control tasks, the lab's experiments will base on simple control applications experiments will use state-of-the-art industrial specification tools (MATLAB/Simulink, LabVIEW, NXC) in order to model cyber-physical model interact with the environment via sensors and actors.			
Skills	After successful attendance of the lab, students are able to develop simple CPS. They understand the interder surrounding processes which stem from the fact that a CPS interacts with the environment via sensors, A/D converte and actors. The lab enables students to compare modelling approaches, to evaluate their advantages and limitation use for a concrete task. They will be able to apply these techniques to practical problems. They obtain first expendevelopment, in industry-relevant specification tools and in the area of simple control applications.	ers, digital proce ons, and to decid	ssors, D/A converte le which technique	
Personal Competence				
Social Competence				
Autonomy	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other class	ses.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	n Project			
Examination duration and scale	Execution and documentation of all lab experiments			
Assignment for the Following	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Elective Compulso	ory		
Curricula	Computer Science: Specialisation Computer and Software Engineering: Elective Compulsory			
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Elective Compulsor	ry		
	Computational Science and Engineering: Specialisation Computer Science: Elective Compulsory			
	Mechatronics: Specialisation Intelligent Systems and Robotics: Elective Compulsory			
	Mechatronics: Specialisation System Design: Elective Compulsory			
	Mechatronics: Technical Complementary Course: Elective Compulsory			

Course L1740: Lab Cyber-Physical	Systems
Тур	Problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Heiko Falk
Language	DE/EN
Cycle	SoSe
Content	Experiment 1: Programming in NXC Experiment 2: Programming the Robot in Matlab/Simulink Experiment 3: Programming the Robot in LabVIEW
Literature	 Peter Marwedel. Embedded System Design - Embedded System Foundations of Cyber-Physical Systems. 2nd Edition, Springer, 2012. Begleitende Foliensätze



Module M0732: Software En	ngineering			
modalo morozi conmaro zi				
Courses				
Title		Тур	Hrs/wk	CP
Software Engineering (L0627)		Lecture	2	3
Software Engineering (L0628)		Recitation Section (small)	2	3
Module Responsible	Prof. Sibylle Schupp			
Admission Requirements	None			
Recommended Previous	A shared the arm and formal language			
Knowledge	Automata theory and formal languages			
	Procedural programming or Functional programming			
	 Object-oriented programming, algorithms, and data structure 	es .		
Educational Objectives	After taking part successfully, students have reached the following le	earning results		
Professional Competence				
Knowledge	Students explain the phases of the software life cycle, describe the	fundamental terminology and concept	s of software enginee	ring, and paraphrase the
	principles of structured software development. They give examples of software-engineering tasks of existing large-scale systems. They write test case:			
	for different test strategies and devise specifications or models using different notations, and critique both. They explain simple design patterns and the			
	major activities in requirements analysis, maintenance, and project	planning.		
Skills	s For a given task in the software life cycle, students identify the corresponding phase and select an appropriate method. They choose the I			
	approach for quality assurance. They design tests for realistic systems, assess the quality of the tests, and find errors at different levels. They apply an			
	modify non-executable artifacts. They integrate components based on interface specifications.			
Personal Competence				
Social Competence				
Autonomy	Using on-line quizzes and accompanying material for self study, st	udents can assess their level of knowl	edge continuously an	d adjust it appropriately.
	Working on exercise problems, they receive additional feedback.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program, 7 semester): Spec	ialisation Computer Science: Elective	Compulsory	
Curricula	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program, 7 semester): Speci	alisation Computer Science: Elective (Compulsory	
	Computational Science and Engineering: Specialisation Computer	Science: Elective Compulsory		
	Technomathematics: Specialisation II. Informatics: Elective Compul-	sory		
	•			

Course L0627: Software Engineerin	g
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Sibylle Schupp
Language	EN
Cycle	SoSe
Content	
	 Software Life Cycle Models (Waterfall, V-Model, Evolutionary Models, IncrementalModels, Iterative Models, Agile Processes) Requirements (Elicitation Techniques, UML Use Case Diagrams, Functional and Non-Functional Requirements) Specification (Finite State Machines, Extended FSMs, Petri Nets, Behavioral UML Diagrams, Data Modeling) Design (Design Concepts, Modules, (Agile) Design Principles) Object-Oriented Analysis and Design (Object Identification, UML Interaction Diagrams, UML Class Diagrams, Architectural Patterns) Testing (Blackbox Testing, Whitebox Testing, Control-Flow Testing, Data-Flow Testing, Testing in the Large) Maintenance and Evolution (Regression Testing, Reverse Engineering, Reengineering) Project Management (Blackbox Estimation Techniques, Whitebox Estimation Techniques, Project Plans, Gantt Charts, PERT Charts)
Literature	Kassem A. Saleh, Software Engineering, J. Ross Publishing 2009.

Course L0628: Software Engineering		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Sibylle Schupp	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0971: Operating S	Systems			
3	.,			
Courses				
Title		Тур	Hrs/wk	СР
Operating Systems (L1153)		Lecture	2	3
Operating Systems (L1154)		Recitation Section (sma	ll) 2	3
Module Responsible	Prof. Volker Turau			
Admission Requirements	None			
Recommended Previous	Object of a today or a series of the series	and data atmosphere		
Knowledge	Object-oriented programming, algorithms,	and data structures		
	Procedural programming	Control of the Contro		
		ing systems such as editors, linkers, compilers		
	Experience in using C-libraries			
Educational Objectives	After taking part successfully, students have reach	ed the following learning results		
Professional Competence				
Knowledge	Students explain the main abstractions process, virtual memory, deadlock, lifelock, and file of operations systems, describe the process states and their			
	transitions, and paraphrase the architectural variants of operating systems. They give examples of existing operating systems and explain their			
	architectures. The participants of the course write concurrent programs using threads, conditional variables and semaphores. Students can describe the			
	variants of realizing a file system. Students explain at least three different scheduling algorithms.			
Claite	Children are able to use the DOCIV libraries to		siant That are able to	index the efficiency of
Skills	s Students are able to use the POSIX libraries for concurrent programming in a correct and efficient way. They are able to judge the efficiency of a scheduling algorithm for a given scheduling task in a given environment.			
	scrieduling algorithm for a given scrieduling task i	n a given environment.		
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lectu	re 56		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program):	Specialisation Computer Science: Compulsory		
Curricula	General Engineering Science (German program,	7 semester): Specialisation Computer Science: E	Elective Compulsory	
	Computer Science: Core qualification: Compulsor	y		
	General Engineering Science (English program):	Specialisation Computer Science: Compulsory		
	General Engineering Science (English program, 7	semester): Specialisation Computer Science: E	lective Compulsory	
	Computational Science and Engineering: Special	sation Computer Science: Elective Compulsory		
	Technomathematics: Specialisation II. Informatics	Elective Compulsory		

Course L1153: Operating Systems			
Тур	Lecture		
Hrs/wk	2		
CP			
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Volker Turau		
Language	DE		
Cycle	SoSe		
Content	 Architectures for Operating Systems Processes Concurrency Deadlocks Memory organization Scheduling File systems 		
Literature	Operating Systems, William Stallings, Pearson International Edition Moderne Betriebssysteme, Andrew Tanenbaum, Pearson Studium		

Course L1154: Operating Systems		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Volker Turau	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1062: Mathematic	cal Statistics			
Courses				
Title		Тур	Hrs/wk	CP
Mathematical Statistics (L1339)		Lecture	3	4
Mathematical Statistics (L1340)		Recitation Section (small)	1	2
Module Responsible	Prof. Anusch Taraz	<u> </u>		
Admission Requirements	none			
Recommended Previous	Mathematical Stochastics			
Knowledge	Measure Theory and Stochastics			
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	Students can name the basic concepts in Mathematical St Students can discuss logical connections between these of They know proof strategies and can reproduce them.	·		•
Skills	 Students can model problems in Mathematical Statistics with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods. Students are able to discover and verify further logical connections between the concepts studied in the course. For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results. 			
Personal Competence Social Competence	 Students are able to work together in teams. They are cap In doing so, they can communicate new concepts accord check and deepen the understanding of their peers. 			v can design examples to
Autonomy	 Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in solving them. Students have developed sufficient persistence to be able to work for longer periods in a goal-oriented manner on hard problems. 			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following	General Engineering Science (German program, 7 semester): Sp	ecialisation Computer Science: Elective	Compulsory	
Curricula	Computer Science: Specialisation Computational Mathematics: E	Elective Compulsory		
	General Engineering Science (English program, 7 semester): Spo	ecialisation Computer Science: Elective	Compulsory	
i	Computational Science and Engineering: Specialisation Comput	er Science: Elective Compulsory		
1	Technomathematics: Specialisation I. Mathematics: Elective Com	pulsory		

Course L1339: Mathematical Statistics	
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE/EN
Cycle	SoSe
Content	 Substitution and Maximum-Likelihood methods for construction of estimators Optimal unfalsified estimators Optimal tests for parametric probability distributions (Neymann-Pearson theory) Sufficiency and completeness and their application to estimation and test problems Tests in normal distribution (e.g. Student's test) Confidence domains and test families
Literature	 V. K. Rohatgi and A. K. Ehsanes Saleh (2001). An introduction to probability and statistics. Wiley. L. Wasserman (2010). All of statistics: A concise course in statistical inference. Springer. H. Witting (1985). Mathematische Statistik: Parametrische Verfahren bei festem Stichprobenumfang. Teubner.



Course L1340: Mathematical Statistics	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Specialization Mechanical Engineering

The educational goal of this Bachelor's program is to develop the skills to select and link fundamental methods and procedures in order to solve technical problems in the field of General Engineering science, especially in the selected subject area of specialisation.

Graduates have:

- 1) Sound knowledge in the subject areas mathematics, thermodynamics, mechanics, electrical Engineering and computer science.
- 2) A basic knowledge in the field of measurement and control engineering, fluid mechanics and materials science.
- 3) In-depth knowledge in Engineering applications, especially in the selected subject area of focus (product development and manufacturing, material science, aircrafts, energy Engineering, mechatronics, medical engineering, theoretical mechanical engineering). They have in particular the necessary methodological knowledge and its application to engineering problems, taking into account technical specifications and economic and social parameters.
- 4) The ability to work scientifically and to expand their specialized knowledge independently.

Graduates are able to work responsibly and competently as mechanical engineers, especially in occupations related to the selected subject area of focus.

Module M0598: Mechanical	Engineering: Design			
Courses				
Title		Тур	Hrs/wk	СР
Embodiment Design and 3D-CAD (L0268)		Lecture	2	1
-			3	2
Mechanical Design Project I (L0695)		Practical Course		
Mechanical Design Project II (L0592)	n.	Practical Course	3	2
eam Project Design Methodology (L0267)	Problem-based Learning	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	Fundamentals of Mechanical Engineering Design			
Knowledge	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	 explain design guidelines for machinery parts e.g. consident 	ering load situation, materials and manufa	acturing requirements,	
	 describe basics of 3D CAD, 			
	 explain basics methods of engineering designing. 			
Chille	After a section the great due to the section of the			
SKIIIS	After passing the module, students are able to:			
	 independently create sketches, technical drawings and de 	cumentations e.g. using 3D CAD,		
	 design components based on design guidelines autonom 	ously,		
	dimension (calculate) used components,			
	 use methods to design and solve engineering design task 	e evetamtically and colution-oriented		
		s systamically and solution-onemed,		
	apply creativity techniques in teams.			
Personal Competence				
Social Competence	After passing the module, students are able to:			
	dovolon and avaluate colutions in groups including making	a and documenting decisions		
	develop and evaluate solutions in groups including making and evaluate the support of a significant states do not be a significant state.	g and documenting decisions,		
	moderate the use of scientific methods,			
	 present and discuss solutions and technical drawings with 	in groups,		
	 reflect the own results in the work groups of the course. 			
Autonomy	Students are able			
ridionomy				
	 to estimate their level of knowledge using activating meth 	nods within the lectures (e.g. with clickers)),	
	To solve engineering design tasks systematically.			
Workload in Hours	Independent Study Time 40, Study Time in Lecture 140			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180			
Assignment for the Following	General Engineering Science (German program): Specialisation	Energy and Enviromental Engineering: C	ompulsory	
Curricula	General Engineering Science (German program): Specialisation	Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation	Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Sp		mpulsorv	
	General Engineering Science (German program, 7 semester): Sp			
i i	General Engineering Science (German program, 7 semester): Sp	• • • • • • • • • • • • • • • • • • • •	gineering: Compulsory	
	Energy and Environmental Engineering: Core qualification: Com	·		
		Energy and Enviromental Engineering: Co	ompulsory	
	General Engineering Science (English program): Specialisation I			
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I	Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation I			
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I	Biomedical Engineering: Compulsory	noulsory	
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Sp	Biomedical Engineering: Compulsory ecialisation Mechanical Engineering: Con		
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp	Biomedical Engineering: Compulsory ecialisation Mechanical Engineering: Conecialisation Biomedical Engineering: Com	npulsory	
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp	Biomedical Engineering: Compulsory ecialisation Mechanical Engineering: Conecialisation Biomedical Engineering: Com	npulsory	
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp	Biomedical Engineering: Compulsory ecialisation Mechanical Engineering: Conecialisation Biomedical Engineering: Com	npulsory	



Naval Architecture: Core qualification: Compulsory

Course L0268: Embodiment Design	and 3D-CAD		
Тур	Lecture		
Hrs/wk			
CP	1		
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28		
Lecturer	Prof. Dieter Krause		
Language	DE		
Cycle	WiSe		
Content	Basics of 3D CAD technology Practical course to apply a 3D CAD system Introduction to the system Sketching and creation of components Creation of assemblies Deriving technical drawings		
Literature	 CAx für Ingenieure eine praxisbezogene Einführung; Vajna, S., Weber, C., Bley, H., Zeman, K.; Springer-Verlag, aktuelle Auflage. Handbuch Konstruktion; Rieg, F., Steinhilper, R.; Hanser; aktuelle Auflage. Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Technisches Zeichnen: Grundlagen, Normen, Beispiele, Darstellende Geometrie, Hoischen, H; Hesser, W; Cornelsen, aktuelle Auflage. Maschinenelemente, Band I-Ill; Niemann, G., Springer-Verlag, aktuelle Auflage. Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage. 		

Course L0695: Mechanical Design F	Project I		
Тур	Practical Course		
Hrs/wk	3		
CP			
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42		
Lecturer	Prof. Thorsten Schüppstuhl		
Language	DE		
Cycle	WiSe		
Content	Create a technical documentation of an existing mechanical model Consolidation of the following aspects of technical drawings: Presentation of technical objects and standardized parts (bearings, seals, shaft-hub joints, detachable connections, springs, axes and shafts) Sectional views Dimensioning Tolerances and surface specifications Creating a tally sheet		
Literature	 Hoischen, H.; Hesser, W.: Technisches Zeichnen. Grundlagen, Normen, Beispiele, darstellende Geometrie, 33. Auflage. Berlin 2011. Labisch, S.; Weber, C.: Technisches Zeichnen. Selbstständig lernen und effektiv üben, 4. Auflage. Wiesbaden 2008. Fischer, U.: Tabellenbuch Metall, 43. Auflage. Haan-Gruiten 2005. 		



Course L0592: Mechanical Design Project II		
Тур	tical Course	
Hrs/wk	3	
СР	2	
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42	
Lecturer	Prof. Wolfgang Hintze	
Language	DE	
Cycle	SoSe	
Content	Generation of sketches for functions and sub-functions Approximately calculation of shafts Dimension of bearings, screw connections and weld Generation of engineering drawings (assembly drawings, manufacturing drawing)	
Literature	Dubbel, Taschenbuch für Maschinenbau, Beitz, W., Küttner, KH., Springer-Verlag. Maschinenelemente, Band I - III, Niemann, G., Springer-Verlag. Maschinen- und Konstruktionselemente, Steinhilper, W., Röper, R., Springer-Verlag. Einführung in die DIN-Normen, Klein, M., Teubner-Verlag. Konstruktionslehre, Pahl, G., Beitz, W., Springer-Verlag.	

Course L0267: Team Project Design	n Methodology	
Тур	Problem-based Learning	
Hrs/wk		
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause	
Language	DE	
Cycle	SoSe	
Content	Introduction to engineering designing methodology Team Project Design Methodology Creating requirement lists Problem formulation Creating functional structures Finding solutions Evaluation of the found concepts Documentation of the taken methodological steps and the concepts using presentation slides	
Literature	 Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage. Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage. Sowie weitere Bücher zu speziellen Themen 	



Module M0933: Fundament	als of Materials Science			
nodale mosso. i dildaliletti	als of materials objetice			
Courses				
itle		Тур	Hrs/wk	CP
Fundamentals of Materials Science I (L1085)		Lecture	2	2
	anced Ceramic Materials, Polymers and Composites) (L0506)	Lecture	2	2
hysical and Chemical Basics of Materials		Lecture	2	2
Module Responsible	*			
Admission Requirements	None			
Recommended Previous	Highschool-level physics, chemistry und mathematics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence		·		
Knowledge	The students have acquired a fundamental knowledge on m	etals, ceramics and polymers a	nd can describe this know	rledge comprehensive
•	Fundamental knowledge here means specifically the issues of a			
	mechanical properties. The students know about the key aspec	cts of characterization methods for	materials and can identify	relevant approaches
	characterizing specific properties. They are able to trace materials	s phenomena back to the underlyin	g physical and chemical lav	vs of nature.
Chillo	The students are able to trace meterials phanemans head to the	underlying physical and shemical	lowe of nature Materials al	hanamana hara rafarr
Skills	The students are able to trace materials phenomena back to the			
	mechanical properties such as strength, ductility, and stiffness, c			
	solidification, precipitation, or melting. The students can explain		onditions and the materials	microstructure, and t
	can account for the impact of microstructure on the material's beh	avioi.		
Paysanal Campatana				
Personal Competence				
Social Competence				
Autonomy	Indiana de A Chidu Timo OC Chidu Timo in Lankius OA			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation		ory	
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): Sp			
i	General Engineering Science (German program, 7 semester): Sp	ecialisation Biomedical Engineerin	ig: Compulsory	
	Canada Fasinassias Caisass (Communication 7	anialization Naval Assistants		
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp	ecialisation Energy and Enviromen		у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com	ecialisation Energy and Enviromen oulsory	ntal Engineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation (ecialisation Energy and Enviromen oulsory Energy and Enviromental Engineeri	ntal Engineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Comp General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I	ecialisation Energy and Enviromen bulsory Energy and Enviromental Engineeri Jechanical Engineering: Compulso	ntal Engineering: Compulsor ing: Compulsory ory	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I	ecialisation Energy and Enviromen bulsory Energy and Enviromental Engineeri Mechanical Engineering: Compulso Biomedical Engineering: Compulso	ntal Engineering: Compulsor ing: Compulsory ory	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I	ecialisation Energy and Enviromen bulsory Energy and Enviromental Engineeri Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory	ntal Engineering: Compulsor ing: Compulsory ory rry	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Specialisation I	ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineeri Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory ecialisation Mechanical Engineerin	ntal Engineering: Compulsor ing: Compulsory ory ry g: Compulsory	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Spe	ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineeri Mechanical Engineering: Compulso Biomedical Engineering: Compulso Javal Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering	ntal Engineering: Compulsor ing: Compulsory ory g: Compulsory g: Compulsory	у
	General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Comp General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Specialisation I General Engineering Science (English program, 7 semester): Specialisation I General Engineering Science (English program, 7 semester): Specialisation I	ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineeri Mechanical Engineering: Compulso Biomedical Engineering: Compulso Javal Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Naval Architecture: Compulsion	atal Engineering: Compulsor ing: Compulsory pry g: Compulsory g: Compulsory mpulsory mpulsory	
	General Engineering Science (German program, 7 semester): Special Engineering Science (Harding Science) (Harding Science	ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Compulsory Biomedical Engineering: Compulsory Biomedical Engineering: Compulsory Biomedical Engineering Engineering Edilisation Mechanical Engineering Biomedical Eng	atal Engineering: Compulsor ing: Compulsory pry g: Compulsory g: Compulsory mpulsory mpulsory	
	General Engineering Science (German program, 7 semester): Special Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Specialisation I General Engineering Science (English program, 7 semester): Specialisation I General Engineering Science (English program, 7 semester): Specialisation Engineering Science (English program, 7 semester): Specialisation Engineering Science: Elect	ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Compulsory Biomedical Engineering: Compulsory Biomedical Engineering: Compulsory Biomedical Engineering Engineering Edilisation Mechanical Engineering Biomedical Eng	atal Engineering: Compulsor ing: Compulsory pry g: Compulsory g: Compulsory mpulsory mpulsory	
	General Engineering Science (German program, 7 semester): Special Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Specialisation I General Engineering Science (English program, 7 semester): Specialisation I General Engineering Science (English program, 7 semester): Specialisation Engineering Science (English program, 7 semester): Specialisation Engineering Science: Elect Mechanical Engineering: Core qualification: Compulsory	ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Compulsory Biomedical Engineering: Compulsory Biomedical Engineering: Compulsory Biomedical Engineering Engineering Edilisation Mechanical Engineering Biomedical Eng	atal Engineering: Compulsor ing: Compulsory pry g: Compulsory g: Compulsory mpulsory mpulsory	
	General Engineering Science (German program, 7 semester): Special Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Specialisation I General Engineering Science (English program, 7 semester): Specialisation I General Engineering Science (English program, 7 semester): Specialisation Engineering Science (English program, 7 semester): Specialisation Engineering Science: Elect	ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Compulsory Biomedical Engineering: Compulsory Biomedical Engineering: Compulsory Biomedical Engineering Engineering Edilisation Mechanical Engineering Biomedical Eng	atal Engineering: Compulsor ing: Compulsory pry g: Compulsory g: Compulsory mpulsory mpulsory	

Course L1085: Fundamentals of Materials Science I		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Jörg Weißmüller	
Language	DE	
Cycle	WiSe	
Content		
Literature	Vorlesungsskript	
	W.D. Callister: Materials Science and Engineering - An Introduction. 5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7	



Course L0506: Fundamentals of Ma	terials Science II (Advanced Ceramic Materials, Polymers and Composites)
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Bodo Fiedler, Prof. Gerold Schneider
Language	DE
Cycle	SoSe
Content	Chemische Bindungen und Aufbau von Festkörpern; Kristallaufbau; Werkstoffprüfung; Schweißbarkeit; Herstellung von Keramiken; Aufbau und
	Eigenschaften der Keramik; Herstellung, Aufbau und Eigenschaften von Gläsern; Polymerwerkstoffe, Makromolekularer Aufbau; Struktur und
	Eigenschaften der Polymere; Polymerverarbeitung; Verbundwerkstoffe
Literature	Vorlesungsskript
	W.D. Callister: Materials Science and Engineering -An Introduction-5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7

Course L1095: Physical and Chemic	ral Rasirs of Materials Science		
,	Lecture		
Hrs/wk			
CP			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Stefan Müller		
Language	DE		
Cycle	WiSe		
Content	Motivation: "Atoms in Mechanical Engineering?" Basics: Force and Energy The electromagnetic Interaction "Detour": Mathematics (complex e-funktion etc.) The atom: Bohr's model of the atom Chemical bounds The multi part problem: Solutions and strategies Descriptions of using statistical thermodynamics Elastic theory of atoms Consequences of atomar properties on makroskopic Properties: Discussion of examples (metals, semiconductors, hybrid systems)		
Literature	Für den Elektromagnetismus: Bergmann-Schäfer: "Lehrbuch der Experimentalphysik", Band 2: "Elektromagnetismus", de Gruyter Für die Atomphysik: Haken, Wolf: "Atom- und Quantenphysik", Springer Für die Materialphysik und Elastizität: Hornbogen, Warlimont: "Metallikunde", Springer		



Module M0680: Fluid Dynar	nics			
0				
Courses				
Title		Тур	Hrs/wk	CP
Fluid Mechanics (L0454) Fluid Mechanics (L0455)		Lecture Recitation Section (large)	3	4
Module Responsible	Prof. Thomas Rung	Heditation dection (large)	2	2
Admission Requirements	•			
	none Sound knowledge of engineering methomatics, engineering make	vanios and thermodynamics		
Recommended Previous Knowledge	Sound knowledge of engineering mathematics, engineering mechanics and thermodynamics.			
0	After taking part auggestafully at idente have reached the following	loorning roculto		
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence	Or death will be a like and to death and to be a late.		and a boundary of flooding of	New Janets and the Property of
Knowledge	Students will have the required sound knowledge to explain the			•
	outline the rationale of flow physics using mathematical models	and are familiar with methods for the pe	errormance analysis a	and the prediction of fluid
	engineering devices.			
Skills	Students are able to apply fluid-engineering principles and flow-p	hysics models for the analysis of technic	cal systems. The lectu	re enables the student to
	carry out all necessary theoretical calculations for the fluid dynamic	c design of engineering devices on a sc	ientific level.	
Personal Competence				
Social Competence	The students are able to discuss problems and jointly develop sol	ution strategies.		
Autonomy	The students are able to develop solution strategies for complex p	roblems self-consistent and crtically ana	lyse results.	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation I	Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation B	Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation I			
	General Engineering Science (German program, 7 semester): Spe	ecialisation Mechanical Engineering: Co	mpulsory	
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): Spe	·	ory	
	General Engineering Science (English program): Specialisation M			
	General Engineering Science (English program): Specialisation E			
	General Engineering Science (English program): Specialisation N			
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe		ory	
	Computational Science and Engineering: Specialisation Engineer	ring Sciences: Elective Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory	tive Communication		
	Technomathematics: Specialisation III. Engineering Science: Elec	uve Compulsory		

Course L0454: Fluid Mechanics		
Тур	Lecture	
Hrs/wk		
CP	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Thomas Rung	
Language	DE	
Cycle	SoSe	
Content	Overview Physical/mathematical modelling Special phenomena Basic equations of fluid dynamics The turbulence problem One dimensional theory for inkompressibel flows One dimensional theory for kompressibel flows Flow over contours without friction Flow over contours with friction Flow through channels Simplified equations for three dimensional flow Special aspects of the numerical solution for complex flows	
Literature	 Herwig, H.: Strömungsmechanik, 2. Auflage, Springer- Verlag, Berlin, Heidelberg, 2006 Herwig, H.: Strömungsmechanik von A-Z, Vieweg Verlag, Wiesbaden, 2004 	



Course L0455: Fluid Mechanics	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Thomas Rung
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Courses				
Title		Тур	Hrs/wk	CP
Mechanics IV (Kinetics II, Oscillations, An	alytical Mechanics, Multibody Systems) (L1137)	Lecture	3	3
	alytical Mechanics, Multibody Systems) (L1138)	Recitation Section (small)	2	2
	alytical Mechanics, Multibody Systems) (L1139)	Recitation Section (large)	1	1
Module Responsible	Prof. Robert Seifried			
Admission Requirements	none			
Recommended Previous	Mathematics I-III and Mechanics I-III			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follo	ving learning results		
Professional Competence				
Knowledge	The students can			
	 describe the axiomatic procedure used in mechanical 	contexts:		
	explain important steps in model design;	,		
	present technical knowledge.			
Skills	The students can			
	explain the important elements of mathematical / mecl	anical analysis and model formation, and app	ply it to the context of	their own problems;
	 apply basic methods to engineering problems; 			
	estimate the reach and boundaries of the methods and	d extend them to be applicable to wider proble	em sets.	
Personal Competence				
Social Competence	The students can work in groups and support each other to over	ercome difficulties.		
Autonomy	Students are capable of determining their own strengths and	weaknesses and to organize their time and le	arning based on thos	se.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisat	on Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program, 7 semester)		npulsory	
	General Engineering Science (German program, 7 semester)	Specialisation Biomedical Engineering: Com	npulsory	
	General Engineering Science (German program, 7 semester)	Specialisation Naval Architecture: Compulso	ory	
	General Engineering Science (English program): Specialisati	on Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisati	on Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisati	on Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering: Com	npulsory	
	General Engineering Science (English program, 7 semester):	Specialisation Biomedical Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester):	Specialisation Naval Architecture: Compulso	ry	
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science:	Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			
	Theoretical Mechanical Engineering: Technical Complement	ary Course Core Studies: Elective Compulsor	y	

Course L1137: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Lecture	
Hrs/wk	3	
СР	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	- Simple impact problems	
	- Principles of analytical mechanics	
	- Elements of vibration theory	
	- Vibration of Multi-degree of freedom systems	
	- Multibody Systems	
Literature	K. Magnus, H.H. Müller-Slany: Grundlagen der Technischen Mechanik. 7. Auflage, Teubner (2009).	
	D. Gross, W. Hauger, J. Schröder, W. Wall: Technische Mechanik 1-4. 11. Auflage, Springer (2011).	
	W. Schiehlen, P. Eberhard: Technische Dynamik, Springer (2012).	



Course L1138: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



	ent Technology for Mechanical and Process En			
Courses				
Title		Тур	Hrs/wk	СР
Practical Course: Measurement and Control Systems (L1119)		Laboratory Course	2	2
Measurement Technology for Mechanical	and Process Engineers (L1116)	Lecture	2	3
Measurement Technology for Mechanical	and Process Engineers (L1118)	Recitation Section (large)	1	1
Module Responsible	Dr. Sven Krause			
Admission Requirements	none			
Recommended Previous	Basic knowledge of physics, chemistry and electrical engineering	ng		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	Students are able to name the most important fundmentals of	the Measurement Technology (Quantities	and Units, Uncertainty	, Calibration, Static a
	Dynamic Properties of Sensors and Systems).			
	They can outline the most important measuring methods for dif	forant kinds of quantities to be massured	(Floatrical Quantities	Fomporaturo mochani
	quantities, Flow, Time, Frequency).	leterit killus of quantities to be maesured	(Liectical Quantities,	remperature, mechani
	quantities, flow, fille, frequency).			
	They can describe important methods of chemical Analysis (Ga	s Sensors, Spectroscopy, Gas Chromatog	raphy)	
Skills	Students can select suitable measuring methods to given proble	ems and can use refering measurement de	evices in practice.	
	The students are able to orally explain issues in the subject ar	ea of measurement technology and soluti	on approaches as wel	as place the issues
	the right context and application area.			
Personal Competence				
Social Competence	Students can arrive at work results in groups and document the	m in a common report.		
Autonomy	Students are able to familiarize themselves with new measuren	nent technologies.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	105 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisatio		Compulsory	
Curricula	General Engineering Science (German program): Specialisatio			
	General Engineering Science (German program): Specialisatio			
	General Engineering Science (German program): Specialisatio			
	General Engineering Science (German program, 7 semester):			У
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester): § General Engineering Science (German program, 7 semester): §			
	Energy and Environmental Engineering: Core qualification: Cor		uisUly	
	General Engineering Science (English program): Specialisation	' '	Compulsory	
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation		ompulsory	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): S		raineering: Compulsor	v
	General Engineering Science (English program, 7 semester): S	•		,
	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S			
	Mechanical Engineering: Core qualification: Compulsory	pos.aoation i roocos Engineening. Comp	u,	
	Mechatronics: Core qualification: Compulsory			
	Process Engineering: Core qualification: Compulsory			



Trans	Laboratory Course
	Laboratory Course
Hrs/wk	2
CP	
	Independent Study Time 32, Study Time in Lecture 28
	Dr. Wolfgang Schröder
. 33.	DE
Cycle	WiSe/SoSe
Content	Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants automotive exhaust are used.
	Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated. starting will be simulated on a PC and compared with measurement.
	Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michel interferometer and optical fibers demonstrated.
	Experiment 4:Identification of the parameters of a control system and optimal control parameters
Literature	Versuch 1:
	 Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftli Verlagsgesellschaft, Stuttgart, 1974 Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, Münch Wien, 1979 Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung Gebrauchs- und Bedienungsanweisungen VDI-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 Bl.1, 2451 Bl.4, 2453 Bl.5, 2455 Bl.1
	Versuch 2:
	Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren
	Simulationsmethoden, speziell: Verwendung von Blockschaltbildern
	Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze
	Versuch 3:
	 Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984 Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1988 Culshaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989
	Versuch 4:
	 Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden Jan Lunze: Systemtheoretische Grundlagen, Analyse und Entwurf einschleifiger Regelungen



Course L1116: Measurement Technology for Mechanical and Process Engineers		
	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Sven Krause	
Language	DE	
Cycle		
00.110.11		
	1.1 Quantities and Units	
	1.2 Uncertainty	
	1.3 Calibration	
	1.4 Static and Dynamic Properties of Sensors and Systems	
	2 Measurement of Electrical Quantities	
	2.1 Current and Voltage	
	2.2 Impedance	
	2.3 Amplification	
	2.4 Oscilloscope	
	2.5 Analog-to-Digital Conversion	
	2.6 Data Transmission	
	3 Measurement of Nonelectric Quantities	
	3.1 Temperature	
	3.2 Length, Displacement, Angle	
	3.3 Strain, Force, Pressure	
	3.4 Flow	
	3.5 Time, Frequency	
	4 Chemical Analysis	
	4.1 Gas Sensors	
	4.2 Spectroscopy	
	4.3 Gas Chromatography	
	At the end of each lecture students present single measuring techniques and results orally in front of the class.	
Literature	Lerch, R.: "Elektrische Messtechnik; Analoge, digitale und computergestützte Verfahren", Springer, 2006, ISBN: 978-3-540-34055-3.	
	Profos, P. Pfeifer, T.: "Handbuch der industriellen Messtechnik", Oldenbourg, 2002, ISBN: 978-3486217940.	

Course L1118: Measurement Technology for Mechanical and Process Engineers	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Sven Krause
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0865: Fundamen	tals of Production and Quality N	M anagement		
Courses				
Title		Тур	Hrs/wk	СР
Production Process Organization (L0925)		Lecture	2	3
Quality Management (L0926)		Lecture	2	3
Module Responsible	Prof. Hermann Lödding			
Admission Requirements	none			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have	re reached the following learning results		
Professional Competence				
Knowledge	Students are able to explain the contents of	of the lecture of the module.		
Skills	Students are able to apply the methods and models in the module to industrial problems.			
Personal Competence				
Social Competence	-			
Autonomy	-			
Workload in Hours	Independent Study Time 124, Study Time	in Lecture 56		
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 Minuten			
Assignment for the Following	General Engineering Science (German pro	ogram): Specialisation Mechanical Engineering: Elective Co	mpulsory	
Curricula	General Engineering Science (German pro	ogram, 7 semester): Specialisation Mechanical Engineering	: Elective Compulsory	
	General Engineering Science (English pro	ogram): Specialisation Mechanical Engineering: Elective Co	mpulsory	
	General Engineering Science (English pro	ogram, 7 semester): Specialisation Mechanical Engineering:	Elective Compulsory	
	Logistics and Mobility: Specialisation Engi	neering Science: Elective Compulsory		
	Mechanical Engineering: Core qualificatio	n: Elective Compulsory		

Course L0925: Production Process Organization		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Hermann Lödding	
Language	EN	
Cycle	SoSe	
Content	(A) Introduction	
	(B) Product planning	
	(C) Process planning	
	(D) Procurement	
	(E) Manufacturing	
	(F) Production planning and control (PPC)	
	(G) Distribution	
	(H) Cooperation	
Literature	Wiendahl, HP.: Betriebsorganisation für Ingenieure	
	Vorlesungsskript	



Course L0926: Quality Management		
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Hermann Lödding	
Language	EN	
Cycle	SoSe	
Content	Definition and Relevance of Quality Continuous Quality Improvement Quality Management in Product Development Quality Management in Production Processes Design of Experiments	
Literature	 Pfeifer, Tilo: Quality Management. Strategies, Methods, Techniques; Hanser-Verlag, München 2002 Pfeifer, Tilo: Qualitätsmanagement. Strategien, Methoden, Techniken; Hanser-Verlag, München, 3. Aufl. 2001 Mitra, Amitava: Fundamentals of Quality Control and Improvement; Wiley; Macmillan, 2008 Kleppmann, W.: Taschenbuch Versuchsplanung. Produkte und Prozesse optimieren; Hanser-Verlag, München, 6. Aufl. 2009 	



Module M0610: Electrical M	lachines			
0				
Courses				
Title		Тур	Hrs/wk	CP
Electrical Machines (L0293) Electrical Machines (L0294)		Lecture	3 2	4
		Recitation Section (large)	2	2
Module Responsible	NN			
Admission Requirements	none			
Recommended Previous Knowledge	Basics of mathematics, in particular complexe numbers, integrals, diff	erenuais		
Knowieuge	Basics of electrical engineering and mechanical engineering			
Educational Objectives	After taking part successfully, students have reached the following lea	rning results		
Professional Competence				
Knowledge	Students can to draw and explain the basic principles of electric and	magnetic fields.		
	They can describe the function of the standard types of electric m	achines and present the correspor	nding equations and cl	haracteristic curves. For
	typically used drives they can explain the major parameters of the en	·		
01.71	Or death and the selection of the select	· Caldada a cada da Cara cara cara da ca		all to the constant of the constant
Skills	Students arw able to calculate two-dimensional electric and magneti	c fields in particular ferromagnetic ci	rcuits with air gap. For	this they apply the usual
	methods of the design auf electric machines.			
	They can calulate the operational performance of electric machines for	om their given characteristic data ar	nd selected quantities a	and characteristic curves
	They apply the usual equivalent circuits and graphical methods.			
Personal Competence				
Social Competence	none			
Autonomy	Students are able independently to calculate electric and magnati	c fields for applications. They are	able to analyse indepe	endently the operational
	performance of electric machines from the charactersitic data and the	ycan calculate thereof selected quar	ntities and characteristic	c curves.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisation Ene	rgy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specialisation Med	hanical Engineering: Elective Comp	ulsory	
	General Engineering Science (German program, 7 semester): Specia	lisation Energy and Enviromental E	ngineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Specia	lisation Mechanical Engineering: El	ective Compulsory	
	Electrical Engineering: Core qualification: Elective Compulsory			
	Energy and Environmental Engineering: Core qualification: Compuls	ory		
	General Engineering Science (English program): Specialisation Energy	gy and Enviromental Engineering: C	Compulsory	
	General Engineering Science (English program): Specialisation Med	nanical Engineering: Elective Comp	ulsory	
	General Engineering Science (English program, 7 semester): Specia	isation Energy and Enviromental Er	ngineering: Compulsory	1
	General Engineering Science (English program, 7 semester): Specia	isation Mechanical Engineering: Ele	ective Compulsory	
	Computational Science and Engineering: Specialisation Engineering			
	Logistics and Mobility: Specialisation Engineering Science: Elective (Compulsory		
	Mechanical Engineering: Core qualification: Elective Compulsory			
	Mechatronics: Core qualification: Compulsory			



Course L0293: Electrical Machines	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	NN
Language	DE
Cycle	SoSe
Content	Electric field: Coulomb's law, flux (field) line, work, potential, capacitor, energy, force
	Magnetic field: force, flux line, Ampere's law, field at bounderies, flux, magnetic circuit, hysteresis, induction, self-induction, mutual inductance, transformer DC-Machines: Construction and layout, torque generation mechanismen, torque vs speed characteristics, commutation, Asynchronous Machines. Magnetic field, construction and layout, equivalent single line diagram, complex stator current diagram (Heylands'diagram), torque vs. speed characteristics, rotor layout (Squirrelcage vs. sliprings), Synchronous machines, construction and layout, equivalent single line diagrams, no-load and short-cuircuit characteristics, vector diagrams, motor and generator operation drives with variable speed, inverter fed operation, special drives, step motors,
Literature	Hermann Linse, Roland Fischer: "Elektrotechnik für Maschinenbauer", Vieweg-Verlag; Signatur der Bibliothek der TUHH: ETB 313
	Ralf Kories, Heinz Schmitt-Walter: "Taschenbuch der Elektrotechnik"; Verlag Harri Deutsch; Signatur der Bibliothek der TUHH: ETB 122 "Grundlagen der Elektrotechnik" - anderer Autoren Fachbücher "Elektrische Maschinen"

Course L0294: Electrical Machines	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	SoSe
Content	Exercises to the application of electric and magnetic fields.
	Excercises to the operational performance of eletric machines.
Literature	Hermann Linse, Roland Fischer: "Elektrotechnik für Maschinenbauer", Vieweg-Verlag; Signatur der Bibliothek der TUHH: ETB 313
	Ralf Kories, Heinz Schmitt-Walter: "Taschenbuch der Elektrotechnik"; Verlag Harri Deutsch; Signatur der Bibliothek der TUHH: ETB 122
	"Grundlagen der Elektrotechnik" - anderer Autoren
	Fachbücher "Elektrische Maschinen"



Module M0934: Advanced I	Materials			
module moso Advanced	naterials			
Courses				
Title		Тур	Hrs/wk	СР
Advanced Materials Characterization (L10	87)	Lecture	2	2
Advanced Materials Design (L1091)		Lecture	2	2
Advanced Materials Design (L1092)		Recitation Section (large)	2	2
Module Responsible	Prof. Patrick Huber			
Admission Requirements	none			
Recommended Previous	Fundamentals of Materials Science (I and II)			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning	results		
Professional Competence				
Knowledge	The students will be able to explain the properties of advanced material	ls along with their applications in tec	hnology, in parti	cular metallic, ceramic,
	$polymeric, semiconductor, modern \ composite \ materials \ (biomaterials) \ and$	nanomaterials.		
Skilla	The students will be able to colect material configurations according to	the technical peeds and if peeds	a, to docion nou	v motoriola considerina
Skills	The students will be able to select material configurations according to architectural principles from the micro- to the macroscale. The students wi			
	select optimum materials combinations depending on the technical applica	-	iateriais science,	which enables them to
	select optimum materials combinations depending on the technical applica	nions.		
Personal Competence				
Social Competence	The students are able to present solutions to specialists and to develop ide	eas further.		
Autonomy	The students are able to			
	the Second state of the Second second			
	assess their own strengths and weaknesses.			
	define tasks independently.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min	al Facility of the Florida Committee		
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanic		2	
Curricula	General Engineering Science (German program, 7 semester): Specialisation	* *	Joinpulsory	
	General Engineering Science (English program): Specialisation Mechanica			
	General Engineering Science (English program, 7 semester): Specialisation	n Mechanical Engineering: Elective C	ompulsory	
	Mechanical Engineering: Core qualification: Elective Compulsory			

Course L1087: Advanced Materials Characterization	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Patrick Huber
Language	DE
Cycle	SoSe
Content	1. Porous Solids - Preparation, Characterization and Functionalities
	2. Fluidics with nanoporous membranes
	3. X-ray diffraction for microstructure analysis
	4. Thermoplastic elastomers
	5. Optimization of polymer properties by nanoparticles
	6. Fiber composites in automotive
	7. Modeling of materials based on quantum mechanics
	8. Mechanical properties of biomaterials
Literature	William D. Callister und David G. Rethwisch, Materialwissenschaften und Werkstofftechnik, Wiley&Sons, Asia (2011).
	William D. Callister, Materials Science and Technology, Wiley& Sons, Inc. (2007).



Course L1091: Advanced Materials	Design
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Bodo Fiedler, Prof. Stefan Müller, Prof. Patrick Huber, Prof. Gerold Schneider, Prof. Jörg Weißmüller
Language	DE/EN
Cycle	SoSe
Content	Aluminiumlegierungen im Flugzeugbau:
	Korrosionsbeständige Varianten, Legierungen mit niedriger Dichte und hoher Steifigkeit; Ermüdungseigenschaften unter einsatznahen
	Belastungsbedingungen
	Titanlegierungen im Flugzeugbau:
	Hochtemperaturlegierungen für Flugtriebwerke (Kompressor):
	Optimierung von Kriech- und Schwingfestigkeit;
	höchstfeste Legierungen für Flugzeugstrukturbauteile:
	Optimierung von Streckgrenze und Bruchzähigkeit
	Demonstrationsversuche an Aluminium- und Titanlegierungen im Labor
	Metall-Keramik-Verbundwerkstoffe:
	spezifische Vor- und Nachteile
	Herstellung von Funktionskeramiken:
	Multilayer-Keramik für Aktoren in der Mikropositionierungstechnik am Beispiel der PZT-Keramik
	mechanische und elektrische Zuverlässigkeit von Funktionskeramiken
	neue Entwicklungen bei den Polymerlegierungen:
	z.B. thermoplastische Elastomere
	Polymer/Polymer-Verbundwerkstoffe:
	z.B. PE-Faser verstärktes PE
	biologisch abbaubare Polymere und polymere Verbundwerkstoffe:
	z.B. Flachsfasern in Polycaprolakton
	Aufbau und Eigenschaften intermetallischer Aluminide (auf Basis Fe, Ni, Ti)
	Herstellung und Anwendungen von intermetallischen Legierungen
	Phasen- und Gefügeanalyse eines Verbundwerkstoffes auf Basis intermetallischer Phasen (mit Laborübung)
Literature	Vorlesungsunterlagen

Course L1092: Advanced Materials Design	
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Bodo Fiedler, Prof. Stefan Müller, Prof. Patrick Huber, Prof. Gerold Schneider, Prof. Jörg Weißmüller
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Focus Biomechanics

Students with the emphasis Biomechanics get in addition to their core engineering skills, a basic understanding of the medical field focusing on fracture healing and implants. This enables them to understand operational planning as well as recearch and development in this highly interdisciplinary area.

Module M0597: Advanced	Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	CP
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design Advanced Mechanical Engineering Design		Recitation Section (large)	2	1 2
Advanced Mechanical Engineering Design		Lecture Recitation Section (large)	2	1
Module Responsible		. ioonanon coonon (iai go)	-	
Admission Requirements				
Recommended Previous				
Knowledge	 Fundamentals of Mechanical Engineering Design 			
Kilowicago	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the fo	llowing learning results		
Professional Competence				
Knowledge				
	explain complex working principles and functions o			
	explain requirements, selection criteria, application		achine elements,	
	indicate the background of dimensioning calculation	ns.		
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of covered m			
	transfer knowledge learned in the module to new re			
	recognize the content of technical drawings and sch recognize the content of technical drawings and sch	nematic sketches,		
	evaluate complex designs, technically.			
Personal Competence				
Social Competence		a the clean was a way and a decided to the clean		
	Students are able to discuss technical information in	n the lecture supported by activating methods.		
Autonomy				
	Students are able to independently deepen their actions and the transfer of the state of th		and the second second	
	Students are able to acquire additional knowledg	ge and to recapitulate poorly understood conte	ent e.g. by using the	e video recordings of t
	lectures.			
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Specialis	sation Mechanical Engineering, Focus Energy S	ystems: Compulsory	
Curricula	General Engineering Science (German program): Specialis	sation Mechanical Engineering, Focus Aircraft S	ystems Engineering:	Compulsory
	General Engineering Science (German program): Specialis	sation Mechanical Engineering, Focus Materials	in Engineering Scie	nces: Compulsory
	General Engineering Science (German program): Specialis	sation Mechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (German program): Specialis	sation Mechanical Engineering, Focus Product [Development and Pro	oduction: Compulsory
	General Engineering Science (German program): Specialis	sation Mechanical Engineering, Focus Theoretic	al Mechanical Engin	neering: Compulsory
	General Engineering Science (German program, 7 semestr		•	
	General Engineering Science (German program, 7 sem	nester): Specialisation Mechanical Engineering	g, Focus Materials i	n Engineering Science
	Compulsory			
	General Engineering Science (German program, 7 semestr			
	General Engineering Science (German program, 7 seme	ester): Specialisation Mechanical Engineering,	Focus Product Deve	elopment and Production
	Compulsory	anton). Considiration Machaniael Francisco	Facus Theoretical	Machaniaal Fasiassii
	General Engineering Science (German program, 7 seme Compulsory	ester). Specialisation Mechanical Engineering,	Tocus Theoretical	wechanical Engineerii
	General Engineering Science (German program, 7 semest	er): Specialisation Mechanical Engineering Foo	us Biomechanics: Co	omnulsory
	General Engineering Science (German program, 7 semestr			
	General Engineering Science (English program): Specialis			,,,,,,
	General Engineering Science (English program): Specialis			Compulsory
	General Engineering Science (English program): Specialis			
	General Engineering Science (English program): Specialis			, -,
	General Engineering Science (English program): Specialis			duction: Compulsory
	General Engineering Science (English program): Specialis	•	·	
	General Engineering Science (English program, 7 semeste	er): Specialisation Mechanical Engineering, Foci	us Aircraft Systems E	ngineering: Compulsor
	General Engineering Science (English program, 7 sem	ester): Specialisation Mechanical Engineering	, Focus Materials i	n Engineering Science
	Compulsory			
	Compulsory General Engineering Science (English program, 7 semeste	er): Specialisation Mechanical Engineering, Foci	us Mechatronics: Coi	mpulsory
	General Engineering Science (English program, 7 semeste General Engineering Science (English program, 7 seme			
	General Engineering Science (English program, 7 semeste			

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:



Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Mechanical Engineering: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Course L0264: Advanced Mechanic	al Engineering Design II
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	SoSe
Content	Advanced Mechanical Engineering Design I & II
	Lecture
	Fundamentals of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Seals
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank drives
	Sliding bearings
	Elements of fluidics
	Exercise
	Calculation methods of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank gears
	Sliding bearings
	Calculations of hydrostatic systems (fluidics)
Literature	
	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. Teubner-Verlag. Teubner-Verlag.
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Dela (Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Dela (Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Bücher zu speziellen Themen

Course L0265: Advanced Mechanical Engineering Design II	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0262: Advanced Mechanic	al Engineering Design I
	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	Advanced Mechanical Engineering Design I & II
Content	Advanced Mechanical Engineering Design Facility
	Lecture
	Fundamentals of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Seals
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank drives
	 Sliding bearings
	Elements of fluidics
	Exercise
	Calculation methods of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	• Crank gears
	Sliding bearings
	Calculations of hydrostatic systems (fluidics)
Literature	
	 Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	 Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	On the other Distance and the Thomas
	Sowie weitere Bücher zu speziellen Themen

Course L0263: Advanced Mechanical Engineering Design I	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M1277: MED I: Intro	oduction to Anatomy		
Courses			
Title	Typ Hrs/wk CP		
Introduction to Anatomy (L0384)	Lecture 2 3		
Module Responsible	Prof. Udo Schumacher		
Admission Requirements	None		
Recommended Previous	None		
Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	The students can describe basal structures and functions of internal organs and the musculoskeletal system.		
	The students can describe the basic macroscopy and microscopy of those systems.		
Skills	The students can recognize the relationship between given anatomical facts and the development of some common diseases; they can	evolain the	
Okino	relevance of structures and their functions in the context of widespread diseases.	г охрішії шо	
Personal Competence			
Social Competence	The students can participate in current discussions in biomedical research and medicine on a professional level.		
Autonomy	The students are able to access anatomical knowledge by themselves, can participate in conversations on the topic and acquire the relevan	nt knowledge	
	themselves.		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Credit points	3		
Examination	Written exam		
Examination duration and scale	90 minutes		
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory		
Curricula			
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory		
	Electrical Engineering: Specialisation Medical Technology: Elective Compulsory		
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory		
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory		
	Mechanical Engineering: Specialisation Biomechanics: Compulsory		
	Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory		
	Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory		
	Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory		
	Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory		
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory		



Course L0384: Introduction to Anato	оту		
Тур	Lecture		
Hrs/wk			
CP	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Tobias Lange		
Language			
Cycle			
Content	General Anatomy 1st week: The Eucaryote Cell		
	2 nd week: The Tissues 3 rd week: Cell Cycle, Basics in Development		
	4 th week: Musculoskeletal System 5 th week: Cardiovascular System		
	5 th week: Cardiovascular System 6 th week: Respiratory System		
	7 th week: Genito-urinary System		
	8 th week: Immune system		
	9 th week: Digestive System I		
	10 th week: Digestive System II		
	11 th week: Endocrine System		
	12 th week: Nervous System		
	13 th week: Exam		
Literature	Adolf Faller/Michael Schünke, Der Körper des Menschen, 16. Auflage, Thieme Verlag Stuttgart, 2012		



Courses				
itle		Тур	Hrs/wk	CP
ignals and Systems (L0432) ignals and Systems (L0433)		Lecture Recitation Section (large)	3 1	4 2
Module Responsible	Prof. Gerhard Bauch	Hookaton Gooton (kargo)		
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge				
-	The modul is an introduction to the theory of signals and system Further experience with spectral transformations (Fourier series,	· ·	•	·
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and linear	r time-invariant (LTI) systems using metho	ds of signal and syste	em theory. They are a
	to apply the fundamental transformations of continuous-time and $% \left(1\right) =\left(1\right) \left($	discrete-time signals and systems. They of	an describe and ana	yse deterministic sig
	and systems mathematically in both time and image domain. Ir		in time domain and i	mage domain which
	caused by the transition of a continuous-time signal to a discrete-	time signal.		
Skills	The students are able to describe and analyse deterministic sign			
	can analyse and design basic systems regarding important prop		oonse, stability, linear	rity etc They can ass
	the impact of LTI systems on the signal properties in time and free	quency domain.		
Personal Competence	The students are fatally at 100 at 10			
Social Competence	The students can jointly solve specific problems.	——————————————————————————————————————	and district the second	nana a rawa k
Autonomy	The students are able to acquire relevant information from appr	•	roi their level of know	riedge during the lec
Westerdents	period by solving tutorial problems, software tools, clicker system	-		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation		mnulsory	
	General Engineering Science (German program): Specialisation		paicory	
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): Sp		ulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Computer Science: Compuls	ory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Compu	ılsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Bioprocess Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Biomedical Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering, Foo	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester) Compulsory	: Specialisation Mechanical Engineering	g, Focus Materials ir	Engineering Scien
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering, Foo	cus Mechatronics: Cor	npulsory
	General Engineering Science (German program, 7 semester): Compulsory	Specialisation Mechanical Engineering	Focus Theoretical N	Mechanical Engineer
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specialisation (Civil- and Environmental Engagements Co-	nnuleon	
	General Engineering Science (English program): Specialisation (General Engineering Science (English program): Specialisation I		πραιουτή	
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I			
	General Engineering Science (English program): Specialisation (
	General Engineering Science (English program): Specialisation I			
	General Engineering Science (English program): Specialisation I			
	General Engineering Science (English program): Specialisation I			
	General Engineering Science (English program, 7 semester): Sp	ecialisation Electrical Engineering: Comp	ulsory	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Computer Science: Compulso	ory	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Process Engineering: Compu	Isory	
	General Engineering Science (English program, 7 semester): Sp			
	General Engineering Science (English program, 7 semester): Sp			
	General Engineering Science (English program, 7 semester): Sp			
	General Engineering Science (English program, 7 semester): Sp			
	General Engineering Science (English program, 7 semester): Sp			
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering	ı, ⊢ocus Materials ir	ı ⊨ngıneering Scien
	Compulsory			
	General Engineering Science (English program 7 competer): C-	acialization Machanical Engineering Coo-	ue Machatraniaa. C	nuleon
	General Engineering Science (English program, 7 semester): Sp.			
	General Engineering Science (English program, 7 semester):			
		Specialisation Mechanical Engineering,		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	S .
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle Content	Basic classification and description of continuous-time and discrete-time signals and systems
	Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)
	Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

ourse L0433: Signals and Systems	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M1278: MED I: Intro	oduction to Radiology and Radiation Therapy			
ourses				
tle	Typ Hrs/wl	k CP		
roduction to Radiology and Radiation Th	· ·	3		
Module Responsible				
Admission Requirements				
Recommended Previous	s None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge				
	The students can distinguish different types of currently used equipment with respect to its use in radiation therapy.			
	The students can explain treatment plans used in radiation therapy in interdisciplinary contexts (e.g. surgery, internal med	licine).		
	The students can describe the patients' passage from their initial admittance through to follow-up care.			
	Disgraption			
	Diagnostics			
	The students can illustrate the technical base concepts of projection radiography, including angiography and mamn imaging techniques (CT, MRT, US).	nography, as well as s	ection	
	The students can explain the diagnostic as well as therapeutic use of imaging techniques, as well as the technical basis for	or those techniques.		
	The students can choose the right treatment method depending on the patient's clinical history and needs.			
	The student can explain the influence of technical errors on the imaging techniques.			
	The student can draw the right conclusions based on the images' diagnostic findings or the error protocol.			
Skills	s Therapy			
	The students can distinguish curative and palliative situations and motivate why they came to that conclusion.			
	The students can develop adequate therapy concepts and relate it to the radiation biological aspects.			
	The students can use the therapeutic principle (effects vs adverse effects) The students can distinguish different kinds of radiation, can choose the best one depending on the situation (location of the tumor) and energy needed in that situation (irradiation planning). The student can assess what an individual psychosocial service should look like (e.g. follow-up treatment, sports, social help groups, self-h social services, psycho-oncology).			
	Diagnostics			
	The students can suggest solutions for repairs of imaging instrumentation after having done error analyses.			
	The students can classify results of imaging techniques according to different groups of diseases based on their knowle pathophysiology.	dge of anatomy, pathol	ogy an	
Personal Competence				
Social Competence	The students can assess the special social situation of tumor patients and interact with them in a professional way.			
	The students are aware of the special, often fear-dominated behavior of sick people caused by diagnostic and therapeuti	c measures and can me	et ther	
	appropriately.			
Autonomy	The students can apply their new knowledge and skills to a concrete therapy case.			
	The students can introduce younger students to the clinical daily routine.			
	The students are able to access anatomical knowledge by themselves, can participate competently in conversations	s on the topic and acq	uire th	
	relevant knowledge themselves.			
Workload in Hours	s Independent Study Time 62, Study Time in Lecture 28			
Workload in Hours Credit points				
Examination				
Examination duration and scale				
Assignment for the Following		sory		
Curricula	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory	•		
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory			
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechan	ics: Compulsory		
	Electrical Engineering: Specialisation Medical Technology: Elective Compulsory			
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compuls	ory		
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanic	ics: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanical Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory	oo. Oompulsory		
	Mechanical Engineering: Specialisation Biomechanics: Compulsory			
	Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory			
	Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory			
	Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory			
	Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory			



Course L0383: Introduction to Radio	ology and Radiation Therapy
Тур	
Hrs/wk	
CP Waster distance	3
Workload in Hours Lecturer	Independent Study Time 62, Study Time in Lecture 28 Prof. Ulrich Carl, Prof. Thomas Vestring
Language	DE
Cycle	SoSe
Content	The students will be given an understanding of the technological possibilities in the field of medical imaging, interventional radiology and radiation therapy/radiation oncology. It is assumed, that students in the beginning of the course have heard the word "X-ray" at best. It will be distinguished between the two arms of diagnostic (Prof. Dr. med. Thomas Vestring) and therapeutic (Prof. Dr. med. Ulrich Carl) use of X-rays. Both arms depend on special big units, which determine a predefined sequence in their respective departments
Literature	Technik der medizinischen Radiologie" von T. + J. Laubenberg –
	7. Auflage – Deutscher Ärzteverlag – erschienen 1999
	"Klinische Strahlenbiologie" von Th. Herrmann, M. Baumann und W. Dörr –
	4. Auflage - Verlag Urban & Fischer – erschienen 02.03.2006
	ISBN: 978-3-437-23960-1
	"Strahlentherapie und Onkologie für MTA-R" von R. Sauer –
	5. Auflage 2003 - Verlag Urban & Schwarzenberg – erschienen 08.12.2009
	ISBN: 978-3-437-47501-6
	"Taschenatlas der Physiologie" von S. Silbernagel und A. Despopoulus
	8. Auflage – Georg Thieme Verlag - erschienen 19.09.2012
	ISBN: 978-3-13-567708-8
	"Der Körper des Menschen " von A. Faller u. M. Schünke -
	16. Auflage 2004 - Georg Thieme Verlag - erschienen 18.07.2012
	ISBN: 978-3-13-329716-5
	"Praxismanual Strahlentherapie" von Stöver / Feyer –
	1. Auflage - Springer-Verlag GmbH – erschienen 02.06.2000



Courses				
itle		Тур	Hrs/wk	CP
Computer Engineering (L0321) Computer Engineering (L0324)		Lecture Recitation Section (small)	3 1	4
Module Responsible	Prof. Heiko Falk	Treolegion Georgia (Smar)	<u> </u>	
Admission Requirements	None			
Recommended Previous	Basic knowledge in electrical engineering			
Knowledge				
	The successful completion of the labs will be honored during the	evaluation of the module's examination ac	cording to the followi	ng rules:
	1. Upon a passed module examination, the student is gra	nted a bonus on the examination's mar	ks due to the succe	ssful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively, u	p to the next-better grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up t	o 4,0 is not possible.		
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence	This willing part occossion, state in the reaction and the control in the control	g .cca.e		
Knowledge	This module deals with the foundations of the functionality of co	emputing systems. It covers the lavers fro	m the assembly-leve	el programming down
	gates. The module includes the following topics:			er pregramming eemin
	Introduction			
	Combinational logic: Gates, Boolean algebra, Boolean fur		l networks	
	Sequential logic: Flip-flops, automata, systematic hardwar Tachnological foundations	e design		
	 Technological foundations Computer arithmetic: Integer addition, subtraction, multipli 	eation and division		
	Basics of computer architecture: Programming models, MI			
	Memories: Memory hierarchies, SRAM, DRAM, caches			
	 Input/output: I/O from the perspective of the CPU, principle 	s of passing data, point-to-point connection	ns, busses	
Skills	The students perceive computer systems from the architect's p			
	computer systems. The students can analyze, how highly spec			
	components. They are able to distinguish between and to explain	the different abstraction layers of today's	s computing systems	- from gates and circi
	up to complete processors.			
	After successful completion of the module, the students are able	to judge the interdependencies between	a physical computer	system and the softwa
	executed on it. In particular, they shall understand the consequent	nces that the execution of software has on	the hardware-centri	c abstraction layers fr
	the assembly language down to gates. This way, they will be ena	oled to evaluate the impact that these low	abstraction levels ha	ave on an entire syste
	performance and to propose feasible options.			
Personal Competence				
Social Competence	Students are able to solve similar problems alone or in a group as	id to present the results accordingly		
oodar oompeterioo	Cidacino are able to solve similar problems alone of in a group an	to present the results assortingly.		
Autonomy	Students are able to acquire new knowledge from specific literatu	re and to associate this knowledge with ot	her classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes, contents of course and labs			
Assignment for the Following	General Engineering Science (German program): Core qualificati	on: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Sp	ecialisation Computer Science: Compulso	ry	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Bioprocess Engineering: Com	pulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Naval Architecture: Compulso	ry	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Civil Engineering: Compulsory	/	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Electrical Engineering: Compu	ulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Biomedical Engineering: Com	pulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Energy and Enviromental Eng	ineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Compul	sory	
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Compul ecialisation Mechanical Engineering, Focu	sory us Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Compul ecialisation Mechanical Engineering, Focu ecialisation Mechanical Engineering, Focu	sory us Mechatronics: Cor us Biomechanics: Co	npulsory mpulsory
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Compul ecialisation Mechanical Engineering, Focu ecialisation Mechanical Engineering, Focu ecialisation Mechanical Engineering, Focu	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E	npulsory mpulsory ngineering: Compulso
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester):	ecialisation Process Engineering: Compul ecialisation Mechanical Engineering, Focu ecialisation Mechanical Engineering, Focu ecialisation Mechanical Engineering, Focu	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E	npulsory mpulsory ngineering: Compulso
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory	ecialisation Process Engineering: Computering and Engineering, Focuserialisation Mechanical Engineering, Focuserialisation Mechanical Engineering, Focuserialisation Mechanical Engineering, Focuserialisation Mechanical Engineering,	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E , Focus Materials in	mpulsory mpulsory ngineering: Compulso Engineering Science
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester):	ecialisation Process Engineering: Computering and Engineering, Focuserialisation Mechanical Engineering, Focuserialisation Mechanical Engineering, Focuserialisation Mechanical Engineering, Focuserialisation Mechanical Engineering,	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E , Focus Materials in	mpulsory mpulsory ngineering: Compulso Engineering Science
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Compulsory	ecialisation Process Engineering: Compul ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- Specialisation Mechanical Engineering, Specialisation Mechanical Engineering,	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E , Focus Materials in	mpulsory mpulsory ngineering: Compulso Engineering Science Mechanical Engineeri
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester):	ecialisation Process Engineering: Compul ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- Specialisation Mechanical Engineering, Specialisation Mechanical Engineering,	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E , Focus Materials in	mpulsory mpulsory ngineering: Compulso Engineering Science Mechanical Engineeri
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Compulsory	ecialisation Process Engineering: Compul ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focu-	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E , Focus Materials in Focus Theoretical M	mpulsory mpulsory ngineering: Compulso I Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Compul ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focu-	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E , Focus Materials in Focus Theoretical M	mpulsory mpulsory ngineering: Compulso I Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Sp Compulsory General Engineering Science (German program, 7 semester): Sp Computer Science: Core qualification: Compulsory	ecialisation Process Engineering: Compul ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focu-	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E , Focus Materials in Focus Theoretical M	mpulsory mpulsory ngineering: Compulso I Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Sp Compulsory General Engineering Science (German program, 7 semester): Sp Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory	ecialisation Process Engineering: Compuled in the process Engineering of th	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E , Focus Materials in Focus Theoretical M	mpulsory mpulsory ngineering: Compulso I Engineering Scienc Mechanical Engineeri
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Sp Compulsory General Engineering Science (German program, 7 semester): Sp Computer Science: Core qualification: Compulsory	ecialisation Process Engineering: Compuled in the process Engineering of th	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E , Focus Materials in Focus Theoretical M Focus Product Devel us Energy Systems: C	mpulsory mpulsory ngineering: Compulso I Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Sp Compulsory General Engineering Science (German program, 7 semester): Sp Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification	ecialisation Process Engineering: Compul- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- enic Compulsory cialisation Computer Science: Compulsory	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E y, Focus Materials in Focus Theoretical M Focus Product Devel us Energy Systems: C	mpulsory mpulsory ngineering: Compulso I Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Sp Compulsory General Engineering Science (German program, 7 semester): Sp Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification General Engineering Science (English program, 7 semester): Spe	ecialisation Process Engineering: Compul- gicialisation Mechanical Engineering, Focu- gicialisation Mechanical Engineering, Focu- gicialisation Mechanical Engineering, Focu- gicialisation Mechanical Engineering, Focu- Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focu- gicialisation Mechanical Eng	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E Focus Materials in Focus Theoretical M Focus Product Devel us Energy Systems: C	mpulsory mpulsory ngineering: Compulso I Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Spe Compulsory General Engineering Science (German program, 7 semester): Spe Computer Science: Core qualification: Compulsory Electrical Engineering Science (English program): Core qualification General Engineering Science (English program, 7 semester): Spe	ecialisation Process Engineering: Compul- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Focu- ecialisation Mechanical Engineering, Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Engineering, Focu- ecialisation Mechanical Engineering, Focu- eni: Compulsory cialisation Computer Science: Compulsor cialisation Bioprocess Engineering: Comp cialisation Naval Architecture: Compulsor	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E Focus Materials in Focus Theoretical M Focus Product Devel us Energy Systems: C	mpulsory mpulsory ngineering: Compulso Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Spe Compulsory General Engineering Science (German program, 7 semester): Spe Computer Science: Core qualification: Compulsory General Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Spe	ecialisation Process Engineering: Compul- gricalisation Mechanical Engineering, Focu- gricalisation Mechanical Engineering, Focu- gricalisation Mechanical Engineering, Focu- gricalisation Mechanical Engineering, Focu- Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focu- gricalisation Mechanical Engineering, Focu- gricalisation Mechanical Engineering, Focu- gricalisation Computer Science: Compulsory cialisation Bioprocess Engineering: Compulsory cialisation Naval Architecture: Compulsory cialisation Civil Engineering: Compulsory cialisation Civil Engineering: Compulsory cialisation Civil Engineering: Compulsory cialisation Civil Engineering: Compulsory	sory us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E Focus Materials in Focus Theoretical M Focus Product Devel us Energy Systems: C	mpulsory mpulsory ngineering: Compulso I Engineering Scienc Mechanical Engineeri

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Computational Science and Engineering: Core qualification: Compulsory
Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	ng
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	Introduction Combinational Logic Sequential Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005.

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M1279: MED II: Intro	oduction to Biochemistry and Molec	ular Biology		
Courses				
Γitle		Тур	Hrs/wk	CP
ntroduction to Biochemistry and Molecular	Biology (L0386)	Lecture	2	3
Module Responsible	Prof. Hans-Jürgen Kreienkamp			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ned the following learning results		
Professional Competence				
Knowledge	The students can			
	 describe basic biomolecules; 			
	 explain how genetic information is coded 	in the DNA:		
	explain now genetic mornation is coded explain the connection between DNA and			
	- explain the connection between Browalla	proteins,		
Skills	The students can			
	recognize the importance of molecular pa	rameters for the course of a disease:		
	describe selected molecular-diagnostic pri			
	explain the relevance of these procedures			
Personal Competence				
Social Competence	The students can participate in discussions in res	earch and medicine on a technical level.		
Autonomy	The students can develop understanding of topics	s from the course, using technical literature, by themsel	lves.	
Workload in Hours	Independent Study Time 62, Study Time in Lectur	re 28		
Credit points	3			
Examination	Written exam			
Examination duration and scale	60 minutes			
Assignment for the Following	General Engineering Science (German program)	: Specialisation Mechanical Engineering, Focus Biome	echanics: Compulsory	
Curricula	General Engineering Science (German program)	: Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program,	7 semester): Specialisation Biomedical Engineering: C	Compulsory	
	General Engineering Science (German program,	7 semester): Specialisation Mechanical Engineering, F	ocus Biomechanics: Cor	npulsory
	Electrical Engineering: Specialisation Medical Te	chnology: Elective Compulsory		
	General Engineering Science (English program):	Specialisation Mechanical Engineering, Focus Biomed	chanics: Compulsory	
	General Engineering Science (English program):	Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (English program,	7 semester): Specialisation Mechanical Engineering, F	ocus Biomechanics: Com	pulsory
	General Engineering Science (English program,	7 semester): Specialisation Biomedical Engineering: C	ompulsory	
	Mechanical Engineering: Specialisation Biomech	, ,	, ,	
		ment and Business Administration: Elective Compulsor	V	
		Organs and Regenerative Medicine: Elective Compulso	•	
		Technology and Control Theory: Elective Compulsory	,	
	Biomedical Engineering: Specialisation Implants			
	Technomathematics: Core qualification: Elective	' ' '		
	Technomathematics: Specialisation III. Engineerin			
	100on anomation openation in Engineering	ng colonics. Elocato Companion,		

cture
dependent Study Time 62, Study Time in Lecture 28
of. Hans-Jürgen Kreienkamp
Se
iller-Esterl, Biochemie, Spektrum Verlag, 2010; 2. Auflage
ffler, Basiswissen Biochemie, 7. Auflage, Springer, 2008
Se



Iodule M0662: Numerical I	Mathematics I			
ourses				
tle		Тур	Hrs/wk	СР
ımerical Mathematics I (L0417)		Lecture	2	3
umerical Mathematics I (L0418)		Recitation Section (small)	2	3
Module Responsible	Prof. Sabine Le Borne			
Admission Requirements	None			
Recommended Previous Knowledge	Mathematik I + II for Engineering Students (ge basic MATLAB knowledge	rman or english) or Analysis & Linear Algebra I + II f	or Technomathematicia	ans
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	Students are able to			
	explain their core ideas, • repeat convergence statements for the numer	ntegration, least squares problems, eigenvalue pro ical methods, numerical methods with respect to computational and		finding problems an
Skills	Students are able to			
	implement, apply and compare numerical me justify the convergence behaviour of numerica select and execute a suitable solution approa	al methods with respect to the problem and solution a	algorithm,	
Personal Competence				
Social Competence	Students are able to			
Autonomy	 work together in heterogeneously composed teams (i.e., teams from different study programs and background knowledge), explain theore foundations and support each other with practical aspects regarding the implementation of algorithms. Students are capable to assess whether the supporting theoretical and practical excercises are better solved individually or in a team, 			
	to assess their individual progess and, if nece		or in a loani,	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 9	56		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Sp	ecialisation Computer Science: Compulsory		
Curricula	General Engineering Science (German program): Sp	ecialisation Mechanical Engineering, Focus Biomed	nanics: Compulsory	
	General Engineering Science (German program): Sp	ecialisation Mechanical Engineering, Focus Material	s in Engineering Scier	nces: Compulsory
	General Engineering Science (German program): Sp	ecialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 se	, ,	•	
	General Engineering Science (German program, 7	7 semester): Specialisation Mechanical Engineering	ig, Focus Materials in	Engineering Scien
	Compulsory General Engineering Science (German program, 7 se	omastor): Specialisation Biomodical Engineering: Co	moulcon	
	General Engineering Science (German program, 7 se	, ,		mnulsony
	Bioprocess Engineering: Specialisation A - General E		ous Biomediamos. Co	inpulsory
	Computer Science: Specialisation Computational Ma	, ,		
	Electrical Engineering: Core qualification: Elective Co			
	General Engineering Science (English program): Spe	ecialisation Computer Science: Compulsory		
	General Engineering Science (English program): Spe	ecialisation Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Spe	ecialisation Mechanical Engineering, Focus Biomech	anics: Compulsory	
	General Engineering Science (English program): Spe	ecialisation Mechanical Engineering, Focus Material	s in Engineering Scien	ces: Compulsory
	General Engineering Science (English program, 7 se		•	
	General Engineering Science (English program, 7	semester): Specialisation Mechanical Engineering	g, Focus Materials in	Engineering Scien
	Compulsory	annested). Consciolination Biomedia - Feelination Co		
	General Engineering Science (English program, 7 se General Engineering Science (English program, 7 se			mouleony
	Computational Science and Engineering: Core quality		odo Diometriallics. Col	пригосту
	Process Engineering: Specialisation Process Engine	· ·		

Process Engineering: Specialisation Process Engineering: Elective Compulsory



Course L0417: Numerical Mathematics I		
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Sabine Le Borne, Dr. Patricio Farrell	
Language	DE/EN	
Cycle	WiSe	
Content	 Error analysis: Number representation, error types, conditioning and stability Interpolation: polynomial and spline interpolation Numerical integration and differentiation: order, Newton-Cotes formula, error estimates, Gaussian quadrature, adaptive quadrature, difference formulas Linear systems: LU and Cholesky factorization, matrix norms, conditioning Linear least squares problems: normal equations, Gram.Schmidt and Householder orthogonalization, singular value decomposition, regularization Eigenvalue problems: power iteration, inverse iteration, QR algorithm Nonlinear systems of equations: Fixed point iteration, root-finding algorithms for real-valued functions, Newton and Quasi-Newton methods for systems 	
Literature	Stoer/Bulirsch: Numerische Mathematik 1, Springer Dahmen, Reusken: Numerik für Ingenieure und Naturwissenschaftler, Springer	

ourse L0418: Numerical Mathematics I	
Тур	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Sabine Le Borne, Dr. Patricio Farrell
Language	DE/EN
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



ourses			
le	Тур	Hrs/wk	CP
roduction to Control Systems (L0654)	Lecture Recitation Section (small)	2	4 2
oduction to Control Systems (L0655)		2	2
Module Responsible			
Admission Requirements	none		
Recommended Previous	Representation of signals and systems in time and frequency domain, Laplace transform		
Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	Students can represent dynamic system behavior in time and frequency domain, and can in pa	articular explain properties	s of first and second or
	systems	aradaar explain properties	
	They can explain the dynamics of simple control loops and interpret dynamic properties in term	ns of frequency response a	and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.		
	They can explain the role of the phase margin in analysis and synthesis of control loops		
	They can explain the way a PID controller affects a control loop in terms of its frequency response.	ise	
	They can explain issues arising when controllers designed in continuous time domain are impl	lemented digitally	
Skills	Students can transform models of linear dynamic systems from time to frequency domain and v	vice versa	
	They can simulate and assess the behavior of systems and control loops		
	They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules		
	They can analyze and synthesize simple control loops with the help of root locus and frequency	y response techniques	
	They can calculate discrete-time approximations of controllers designed in continuous-time and	d use it for digital impleme	entation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these	tasks	
Personal Competence			
Social Competence	Students can work in small groups to jointly solve technical problems, and experimentally validate their		
Autonomy	Students can obtain information from provided sources (lecture notes, software documentation, ex	xperiment guides) and u	se it when solving gi
	problems.		
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Examination	Written exam		
Examination duration and scale	120 min		
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Com	pulsory	
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering:	: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Com	pulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: C	Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering:	: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmenta	al Engineering: Compulso	ry
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Co	ompulsory	
	deficial Engineering Science (definal program, 7 semester). Specialisation 1 rocess Engineering. Oc		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering.	, Focus Mechatronics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	, Focus Biomechanics: Co	ompulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	, Focus Biomechanics: Co , Focus Aircraft Systems E	ompulsory Engineering: Compulso
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	, Focus Biomechanics: Co , Focus Aircraft Systems E	ompulsory Engineering: Compulso
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	, Focus Biomechanics: Co , Focus Aircraft Systems E ering, Focus Materials in	ompulsory Ingineering: Compulson In Engineering Science
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engine Compulsory	, Focus Biomechanics: Co , Focus Aircraft Systems E ering, Focus Materials in	ompulsory Ingineering: Compulson In Engineering Science
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engine Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Science (German program, 7 semester): S	, Focus Biomechanics: Co , Focus Aircraft Systems E ering, Focus Materials in ering, Focus Theoretical	ompulsory ingineering: Compulso n Engineering Science Mechanical Engineeri
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engine Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory	, Focus Biomechanics: Co , Focus Aircraft Systems E ering, Focus Materials in ering, Focus Theoretical	ompulsory ingineering: Compulso n Engineering Science Mechanical Engineeri
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engine Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer	, Focus Biomechanics: Co , Focus Aircraft Systems E ering, Focus Materials in ering, Focus Theoretical ing, Focus Product Deve	ompulsory Engineering: Compulsor In Engineering Science Mechanical Engineering Iopment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerong Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerong Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerong Compulsory	, Focus Biomechanics: Co , Focus Aircraft Systems E ering, Focus Materials in ering, Focus Theoretical ing, Focus Product Deve	ompulsory Engineering: Compulsor In Engineering Science Mechanical Engineering Iopment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromylasory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromylasory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromylasory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromylasory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	, Focus Biomechanics: Co , Focus Aircraft Systems E ering, Focus Materials in ering, Focus Theoretical ing, Focus Product Deve	ompulsory Engineering: Compulsor In Engineering Science Mechanical Engineering Iopment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromyulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromyulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromyulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromyulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Bioprocess Engineering: Core qualification: Compulsory	, Focus Biomechanics: Co , Focus Aircraft Systems E ering, Focus Materials in ering, Focus Theoretical ing, Focus Product Deve	ompulsory Engineering: Compulsor In Engineering Science Mechanical Engineering Iopment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory	, Focus Biomechanics: Co , Focus Aircraft Systems E ering, Focus Materials in ering, Focus Theoretical ing, Focus Product Deve	ompulsory Engineering: Compulso In Engineering Science Mechanical Engineer Iopment and Product
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory	, Focus Biomechanics: Co , Focus Aircraft Systems E ering, Focus Materials in ering, Focus Theoretical ing, Focus Product Deve	ompulsory Engineering: Compulso In Engineering Science Mechanical Engineer Iopment and Product
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory	, Focus Biomechanics: Cr , Focus Aircraft Systems Bering, Focus Materials in pring, Focus Theoretical ring, Focus Product Deve , Focus Energy Systems:	ompulsory Engineering: Compulso In Engineering Science Mechanical Engineer Iopment and Product
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Enginee Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory	pulsory	ompulsory Engineering: Compulso In Engineering Science Mechanical Engineer Iopment and Product
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Computer Science: Computer Science (English program, 7 semester): Specialisation Computer Science: Computer Science (English program, 7 semester): Specialisation Computer Science: Computer Science: Computer Science (English program, 7 semester): Specialisation Computer Science: Computer Science (English program, 7 semester): Specialisation Computer Science: Computer Science (English program, 7 semester): Specialisation Computer Science: Computer Science (English program, 7 semester): Specialisation Computer Science: Computer Science (English program, 7 semester): Specialisation Science (English program, 7 semester):	pulsory Compulsory Compulsory Compulsory Compulsory Compulsory Content Special S	ompulsory Engineering: Compulso In Engineering Science Mechanical Engineer Iopment and Product
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Dioprocess Engineering: General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Sp	pulsory Compulsory Com	ompulsory Engineering: Compuls In Engineering Science Mechanical Engineer Iopment and Product
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compuser General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compuser General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engin	pulsory Compulsory Usering Compulsory Compulsory Usering Compulsory Compulsory Usering Compulsory Com	ompulsory Engineering: Compulso In Engineering Science Mechanical Engineer Iopment and Product
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compuser Renate Engineering Science (English program, 7 semester): Specialisation Deprocess Engineering: General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compuser Renate Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compuser Renate Engineering Science (English program, 7 semester): Specialisation Deprocess Engineering: Compuser Renate Engineering Science (English program, 7 semester): Specialisation Deprocess Engineering: Compuser Renate Engineering Science (English program, 7 semester): Specialisation Deprocess Engineering: Compuser Renate Engineering Science (English program, 7 semester): Specialisation Deprocess Engineering: Compuser Renate Engineering Science (English program, 7 semester): Specialisation Deprocess Engineering: Compuser Renate Engineering Science (English program, 7 semester): Specialisation Deprocess Engineering: Compuser Renate	pulsory Compulsory on, Focus Biomechanics: Cr pring, Focus Materials in the pring, Focus Theoretical pring, Focus Product Development of the pring of the pring of the pring of the pring of the principal of the	ompulsory Engineering: Compulso In Engineering Science Mechanical Engineeri Iopment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeromy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer Compulsory General Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compuser General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compuser General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compuser General Engineering Science (English program, 7 semester): Specialisation Civil Engin	pulsory Compulsory	empulsory Engineering: Compulsor In Engineering Science Mechanical Engineeri Iopment and Producti Compulsory



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems
	Linear systems, differential equations and transfer functions
	First and second order systems, poles and zeros, impulse and step response
	Stability
	Glability
	Feedback systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Root locus techniques
	Root locus plots
	Root locus design of PID controllers
	Frequency response techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation
	Frequency response interpretation of PID control
	Time delay systems
	Root locus and frequency response of time delay systems
	Smith predictor
	Digital control
	Sampled-data systems, difference equations
	Tustin approximation, digital implementation of PID controllers
	Software tools
	Software tools
	Introduction to Matlab, Simulink, Control toolbox
	Computer-based exercises throughout the course
Literature	
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010



Course L0655: Introduction to Control Systems	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



nts and Fracture Healing			
	Тур	Hrs/wk	СР
	Lecture	2	3
Prof. Michael Morlock			
None			
It is recommended to participate in "Introduction into Anato	omie" before attending "Implants and Fractu	ıre Healing".	
After taking part successfully, students have reached the for	ollowing learning results		
The students can describe the different ways how bones h	eal, and the requirements for their existence	ce.	
The students can name different treatments for the spine a	and hollow bones under given fracture mor	phologies.	
The students can determine the forces acting within the hu	ıman hody undar quasi-static situations un	der enecific accumptions	
The stadents can determine the lordes acting within the no	inian body under quasi-static situations uni	der specific assumptions.	
The students can, in groups, solve basic numerical model $% \left(1\right) =\left(1\right) \left($	ing tasks for the calculation of internal force	es.	
The students can in groups solve basic numerical model	ing tacke for the calculation of internal force	ne.	
The stadents can, in groups, solve basic numerical model	ing tasks for the calculation of internal force		
Independent Study Time 62, Study Time in Lecture 28			
3			
Written exam			
90 min			
General Engineering Science (German program): Special	isation Mechanical Engineering, Focus Bio	mechanics: Compulsory	
General Engineering Science (German program): Special	isation Biomedical Engineering: Compulso	ry	
General Engineering Science (German program, 7 semes	ter): Specialisation Mechanical Engineerin	g, Focus Biomechanics: Cor	npulsory
General Engineering Science (German program, 7 semes	ter): Specialisation Biomedical Engineering	g: Compulsory	
General Engineering Science (English program): Speciali	sation Biomedical Engineering: Compulsor	ry	
General Engineering Science (English program): Speciali	sation Mechanical Engineering, Focus Bio	mechanics: Compulsory	
General Engineering Science (English program, 7 semest	ter): Specialisation Mechanical Engineering	g, Focus Biomechanics: Com	pulsory
General Engineering Science (English program, 7 semest	ter): Specialisation Biomedical Engineering	g: Compulsory	
Mechanical Engineering: Specialisation Biomechanics: C	ompulsory		
Biomedical Engineering: Specialisation Artificial Organs a	nd Regenerative Medicine: Elective Comp	ulsory	
		•	
		ry	
	•	•	
	· ·	,	
	After taking part successfully, students have reached the forms to the students can describe the different ways how bones in the students can name different treatments for the spine at the students can determine the forces acting within the human to the students can, in groups, solve basic numerical model the students can, in groups, solve basic numerical model independent Study Time 62, Study Time in Lecture 28 within the exam solve the students of the students can, in groups, solve basic numerical model independent Study Time 62, Study Time in Lecture 28 substituting the students of the students o	Prof. Michael Morlock None It is recommended to participate in "Introduction into Anatomie" before attending "Implants and Fract. After taking part successfully, students have reached the following learning results The students can describe the different ways how bones heal, and the requirements for their existence. The students can name different treatments for the spine and hollow bones under given fracture morn. The students can determine the forces acting within the human body under quasi-static situations under the students can, in groups, solve basic numerical modeling tasks for the calculation of internal force. The students can, in groups, solve basic numerical modeling tasks for the calculation of internal force independent Study Time 62, Study Time in Lecture 28 Written exam 90 min General Engineering Science (German program): Specialisation Mechanical Engineering: Compulso General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulso General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering: General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering: General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering: General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering: General Engineering: Specialisation Biomedical Engineering: Specialisation Biomedical Engineering: Specialisation Biomedical Engineering: Specialisation Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory	Typ Hrs/wk Lecture 2 Prof. Michael Morlock None It is recommended to participate in "Introduction into Anatomie" before attending "Implants and Fracture Healing". After taking part successfully, students have reached the following learning results The students can describe the different ways how bones heal, and the requirements for their existence. The students can name different treatments for the spine and hollow bones under given fracture morphologies. The students can determine the forces acting within the human body under quasi-static situations under specific assumptions. The students can, in groups, solve basic numerical modeling tasks for the calculation of internal forces. The students can, in groups, solve basic numerical modeling tasks for the calculation of internal forces. Independent Study Time 62, Study Time in Lecture 28 3 Written exam 90 min General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering, Focus Biomechanics: Conferenal Engineering Science (English program): Specialisation Biomedical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program): Specialisation Biomedical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program): Specialisation Biomedical Engineering, Focus Biomechanics: Compulsory Bechanical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory



Course L0376: Implants and Fractur	re Healing
-	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Michael Morlock
Language	DE WiSe
	Topics to be covered include:
	Introduction (history, definitions, background importance)
	2. Bone (anatomy, properties, biology, adaptations in femur, tibia, humerus, radius)
	3. Spine (anatomy, biomechanics, function, vertebral bodies, intervertebral disc, ligaments)
	3.1 The spine in its entirety
	3.2 Cervical spine
	3.3 Thoracic spine
	3.4 Lumbar spine
	3.5 Injuries and diseases
	4. Pelvis (anatomy, biomechanics, fracture treatment)
	5 Fracture Healing
	5.1 Basics and biology of fracture repair
	5.2 Clinical principals and terminology of fracture treatment
	5.3 Biomechanics of fracture treatment
	5.3.1 Screws
	5.3.2 Plates
	5.3.3 Nails
	5.3.4 External fixation devices
	5.3.5 Spine implants
	6.0 New Implants
Literature	Cochran V.B.: Orthopädische Biomechanik
	Mow V.C., Hayes W.C.: Basic Orthopaedic Biomechanics
	White A.A., Panjabi M.M.: Clinical biomechanics of the spine
	Nigg, B.: Biomechanics of the musculo-skeletal system
	Schiebler T.H., Schmidt W.: Anatomie
	Platzer: dtv-Atlas der Anatomie, Band 1 Bewegungsapparat



Courses		
Title	Typ Hrs/wk CP	
ntroduction to Physiology (L0385)	Lecture 2 3	
Module Responsible	Dr. Roger Zimmermann	
Admission Requirements	None	
Recommended Previous	None	
Knowledge		
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge	The students can	
	describe the basics of the energy metabolism;	
	 describe the basics of the energy inetabolism, describe physiological relations in selected fields of muscle, heart/circulation, neuro- and sensory physiology. 	
	country privately and the country privately and the country privately.	
Skills	The students can describe the effects of basic bodily functions (sensory, transmission and processing of information, development of forces a	nd v
	functions) and relate them to similar technical systems.	
Personal Competence		
Social Competence	The students can conduct discussions in research and medicine on a technical level.	
	The students can find solutions to problems in the field of physiology, both analytical and metrological.	
Autonomy	The students can derive answers to questions arising in the course and other physiological areas, using technical literature, by themselves.	
	, , , , , , , , , , , , , , , , , , ,	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Credit points	3	
Examination	Written exam	
Examination duration and scale	60 minutes	
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
	Electrical Engineering: Specialisation Medical Technology: Elective Compulsory	
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
	Mechanical Engineering: Specialisation Biomechanics: Compulsory	
	Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory	
	Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory	
	Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory	
	Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory	
	Technomathematics: Core qualification: Elective Compulsory	
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory	

Course L0385: Introduction to Physiology	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Roger Zimmermann
Language	DE
Cycle	SoSe
Content	
Literature	Taschenatlas der Physiologie, Silbernagl Despopoulos, ISBN 978-3-135-67707-1, Thieme
	Repetitorium Physiologie, Speckmann, ISBN 978-3-437-42321-5, Elsevier



courses				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880) roject Entrepreneurship (L0882)		Lecture Problem-based Learning	3	3
Module Responsible	Prof. Christoph Ihl	1 Tobletti-based Learning		3
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learn	ing results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of many d Marketing and Innovation, and also to Investment and Controlling. In par		nagement, from Plan	ning and Organisation
	explain the differences between Economics and Management at	nd the sub-disciplines in Managem	nent and to name impo	ortant definitions from t
	field of Management			
	explain the most important aspects of and goals in Management			
	describe and explain basic business functions as production, procedures management information management inspection management.		chain management,	organization and hum
	ressource management, information management, innovation m explain the relevance of planning and decision making in Bus		ultiple objectives and	uncertainty and evolu
	some basic methods from mathematical Finance	mess, esp. in situations under me	miple objectives and	uncertainty, and expire
	state basics from accounting and costing and selected controlling	g methods.		
Skills	Students are able to analyse business units with respect to diffe Entrepreneurship project in a team. In particular, they are able to	erent criteria (organization, object	ctives, strategies etc) and to carry out
	analyse Management goals and structure them appropriately			
	analyse organisational and staff structures of companies apply methods for decision making under multiple objectives, un	ider uncertainty and under rick		
	 apply methods for decision making under multiple objectives, un analyse production and procurement systems and Business info 			
	analyse and apply basic methods of marketing	materi eyeteme		
	select and apply basic methods from mathematical finance to pre	edefined problems		
	apply basic methods from accounting, costing and controlling to	predefined problems		
Personal Competence				
Social Competence	Students are able to			
,				
	work successfully in a team of students			
	 to apply their knowledge from the lecture to an entrepreneurship to communicate appropriately and 	project and write a conerent repor	t on the project	
	to cooperate respectfully with their fellow students.			
Autonomy	Students are able to			
	work in a team and to organize the team themselves			
	to write a report on their project.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation Electric	cal Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Compu			
	General Engineering Science (German program): Specialisation Proces	s Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Biopro	cess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Energy			
	General Engineering Science (German program): Specialisation Civil- a		mpulsory	
	General Engineering Science (German program): Specialisation Mecha			
	General Engineering Science (German program): Specialisation Biomed General Engineering Science (German program): Specialisation Naval			
	General Engineering Science (German program, 7 semester): Specialis	• •	oulsorv	
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specialis		-	
	General Engineering Science (German program, 7 semester): Specialis	ation Naval Architecture: Compuls	ory	
	General Engineering Science (German program, 7 semester): Specialis	ation Computer Science: Compuls	ory	
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specialis General Engineering Science (German program, 7 semester): Specialis	-		
	General Engineering Science (German program, 7 semester): Specialis General Engineering Science (German program, 7 semester): Spec	-	•	
	Compulsory		y, 1 0003 iviatellais II	
	General Engineering Science (German program, 7 semester): Specia	alisation Mechanical Engineering	Focus Theoretical N	Acchanical Engineeri
				nechanicai Enumeem



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

Impulsory

 $General\ Engineering\ Science\ (German\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Energy\ Systems:\ Compulsory\ Special\ Special\$

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program): Specialisation Process Engineering: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Electrical\ Engineering:\ Compulsory$

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester). Specialisation Navar Architecture. Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

Simpulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 $\label{thm:mechanical engineering:Core qualification:Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Course L0880: Introduction to Mana	gement
Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgang
	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.
	Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Course L0882: Project Entrepreneu	rship
Тур	Problem-based Learning
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,
	using their knowledge from the corresponding lecture.
	Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Module M1332: BIO I: Expe	rimental Methods in Biomechanics			
Courses				
Title		Тур	Hrs/wk	СР
Experimental Methods in Biomechanics (L	0377)	Lecture	2	3
Module Responsible	Prof. Michael Morlock			
Admission Requirements	None			
Recommended Previous	It is recommended to participate in "Implantate und Frakturheil	ung" before attending "Experimentelle	Methoden".	
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results		
Professional Competence				
Knowledge	The students can describe the different ways how bones heal,	and the requirements for their existen	ce.	
	The students can name different treatments for the spine and $\boldsymbol{\boldsymbol{h}}$	ollow bones under given fracture mor	phologies.	
	The students can describe different measurement techniques	or forces and movements, and choose	e the adequate technique for	a given task.
Skills	The students can describe the basic handling of several expenses	imental techniques used in biomecha	nics.	
Personal Competence				
Social Competence	The students can, in groups, solve basic experimental tasks.			
Autonomy	The students can, in groups, solve basic experimental tasks.			
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28			
Credit points	3			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisati	on Mechanical Engineering, Focus Bio	omechanics: Compulsory	
Curricula	General Engineering Science (German program): Specialisati	on Biomedical Engineering: Compulso	ory	
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering	ng, Focus Biomechanics: Cor	npulsory
	General Engineering Science (German program, 7 semester):	Specialisation Biomedical Engineerin	g: Compulsory	
	General Engineering Science (English program): Specialisation	n Biomedical Engineering: Compulso	ry	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester):			npulsory
	General Engineering Science (English program, 7 semester):		g: Compulsory	
	Mechanical Engineering: Specialisation Biomechanics: Comp Biomedical Engineering: Specialisation Artificial Organs and F	•	uleory	
	Biomedical Engineering: Specialisation Implants and Endopro		ouisoi y	
	Biomedical Engineering: Specialisation Medical Technology a		orv	
	Biomedical Engineering: Specialisation Management and Bus		*	
	Technomathematics: Specialisation III. Engineering Science: B	·	-	
	Biomedical Engineering: Specialisation Management and Bus	iness Administration: Elective Compu	*	

Course L0377: Experimental Methods in Biomechanics	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Michael Morlock
Language	DE
Cycle	SoSe
Content	
Literature	Wird in der Veranstaltung bekannt gegeben



Focus Energy Systems

The aim of the specialization Energy Systems in the field of study Mechanical Engineering of the course of study General Engineering Science is to familiarize students with different technologies for energy conversion, energy distribution and energy application. Graduates are qualified to analyse, abstract and model processes. They are able to evaluate data and results and to develop strategies for finding innovative, energy efficient solutions. They take the connection of different problems into account. Furthermore the graduates are able to document and to communicate scientific results.

The specialization Energy Systems enables a consecutive study of the Master Energy Systems or an economical oriented master study.

	Engineering	
Courses		
Title	Typ Hrs/wk CP	
Computer Engineering (L0321)	Lecture 3 4	
Computer Engineering (L0324)	Recitation Section (small) 1 2	
Module Responsible	Prof. Heiko Falk	
Admission Requirements	None	
Recommended Previous	Basic knowledge in electrical engineering	
Knowledge	The successful completion of the labs will be honored during the evaluation of the module's examination according to the following rules:	
	The successful completion of the last will be noticed during the ovalidation of the incidence of scalinitation according to the following rules.	
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the successful labs, such that	
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.	
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge		
_	gates. The module includes the following topics:	
	• Introduction	
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks	
	Sequential logic: Flip-flops, automata, systematic hardware design Trabella is all foundations.	
	Technological foundations Computes with patient laborated different publication and different publications	
	 Computer arithmetic: Integer addition, subtraction, multiplication and division Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining 	
	Memories: Memory hierarchies, SRAM, DRAM, caches	
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses	
	The production are perspective of the or o, principles or passing data, point to point connections, success	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the physical composition	
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a collection of few and sim	
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing systems - from gates and circ	
	up to complete processors.	
	After successful completion of the module, the students are able to judge the interdependencies between a physical computer system and the softw	
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-centric abstraction layers fi	
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels have on an entire syste	
	performance and to propose feasible options.	
Personal Competence		
Social Competence	Students are able to solve similar problems alone or in a group and to present the results accordingly.	
Autonomy	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.	
Workload in Hours		
Credit points		
Examination	Written exam	
Examination duration and scale	90 minutes, contents of course and labs	
Assignment for the Following		
Curricula		
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering	

Computational Science and Engineering: Core qualification: Compulsory

Technomathematics: Specialisation II. Informatics: Elective Compulsory

Mechatronics: Core qualification: Compulsory



General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Biomedical\ Engineering:\ Compulsory$ General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Course L0321: Computer Engineering	ng	
Тур	ecture	
Hrs/wk		
СР	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Heiko Falk	
Language	DE	
Cycle	WiSe	
Content	 Introduction Combinational Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output 	
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005. 	

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



ourses				
le		Tun	Hrs/wk	CP
		Typ Lecture	Hrs/wk 3	4 4
nals and Systems (L0432) nals and Systems (L0433)		Recitation Section (large)	1	2
	Prof. Gerhard Bauch		·	
	None			
·	Mathematics 1-3			
Knowledge	Water Males 1 0			
	The modul is an introduction to the theory of signals and systems. Government of Further experience with spectral transformations (Fourier series, Fourier			nematik 1-3 is expe
Educational Objectives	After taking part successfully, students have reached the following learn	ning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and linear time-	invariant (LTI) systems using metho	ods of signal and syste	em theory. They are
	to apply the fundamental transformations of continuous-time and discre	te-time signals and systems. They	can describe and anal	yse deterministic si
	and systems mathematically in both time and image domain. In parti-	cular, they understand the effects	in time domain and ir	mage domain whic
	caused by the transition of a continuous-time signal to a discrete-time s	ignal.		
Skills	The students are able to describe and analyse deterministic signals are	nd linear time-invariant systems usi	ng methods of signal	and system theory.
	can analyse and design basic systems regarding important properties	such as magnitude and phase res	ponse, stability, linear	ity etc They can as
	the impact of LTI systems on the signal properties in time and frequency $% \left(1\right) =\left(1\right) \left(1\right) \left$	y domain.		
Personal Competence				
Social Competence	The students can jointly solve specific problems.			
Autonomy	The students are able to acquire relevant information from appropriate	e literature sources. They can conf	trol their level of know	ledge during the le
	period by solving tutorial problems, software tools, clicker system.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
	90 min			
	General Engineering Science (German program): Specialisation Electri	ical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Comp			
Gurricula	General Engineering Science (German program): Specialisation Proce			
	General Engineering Science (German program): Specialisation Proce			
	General Engineering Science (German program): Specialisation Civil-		mnulsory	
	General Engineering Science (German program): Specialisation Mecha		mpaisory	
	General Engineering Science (German program): Specialisation Biome			
	General Engineering Science (German program, 7 semester): Specialis		oulsorv	
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specialis	, , ,		
	General Engineering Science (German program, 7 semester): Specialis			mnulsory
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specialist			
	Compulsory	dansation Mechanical Engineening	y, rocus Materiais III	Lingineering Scie
	' '	sation Machanical Engineering For	ous Machatronias: Con	anulcon/
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Speci	iansanon wechanical Engineering	, rocus ineoretical N	nechanical Engine
	Compulsory			
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory	and Environmental Engage	mouleon	
	General Engineering Science (English program): Specialisation Civil- a		inpuisory	
	General Engineering Science (English program): Specialisation Biopro General Engineering Science (English program): Specialisation Electric			
		0 0 , ,		
	General Engineering Science (English program): Specialisation Compu			
	General Engineering Science (English program): Specialisation Mecha			
	General Engineering Science (English program): Specialisation Biome General Engineering Science (English program): Specialisation Proces			
	General Engineering Science (English program): Specialisation Proces General Engineering Science (English program, 7 semester): Specialis		uleon	
	General Engineering Science (English program, 7 semester): Specialis		•	
	General Engineering Science (English program, 7 semester): Specialis			
	General Engineering Science (English program, 7 semester): Specialis			
	General Engineering Science (English program, 7 semester): Specialis			
	General Engineering Science (English program, 7 semester): Specialis			npulsory
	General Engineering Science (English program, 7 semester): Specialis			
		-		
	General Engineering Science (English program, 7 semester): Specialis			
	General Engineering Science (English program, 7 semester): Spec	aansauon wechanical Engineerin	y, rocus ivialeriais In	Linging enting Scie
	Compulsory General Engineering Science (English program, 7 semester): Specialise	ation Machanical Engineering For	us Machatranias C	nuleon,
	General Engineering Science (English program, 7 semester): Specialis			
	General Engineering Science (English program, 7 semester): Speci	ansalion iviechanical Engineering	, rocus ineoretical N	nechanicai Engine
	Compulacry			
	Compulsory Computational Science and Engineering: Core qualification: Compulso			



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	s
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle Content	SoSe Basic classification and description of continuous-time and discrete-time signals and systems
	Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)
	• Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

Course L0433: Signals and Systems	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0684: Heat Transf	ier er e			
Courses				
Title		Typ	Hrs/wk	CP
		Typ Lecture	3	4
Heat Transfer (L0458) Heat Transfer (L0459)		Recitation Section (large)	2	2
Module Responsible	Dr. Andreas Moschallski	ricollation decitor (large)	2	
Admission Requirements	none			
Recommended Previous	Technical Thermodynamics I, II and Fluid Dynamics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The students are able to			
	- describe the different physical mechanism of Heat Transfer,			
	- explain the technical terms,			
	- to analyse comlex heat transfer processes in a critical way.			
Skills	The students are able to			
	- understand the physics of Heat Transfer,			
	- calculate and evaluate complex Heat Transfer processes,			
	- solve excersises self-consistent and in small groups.			
Personal Competence				
Social Competence	The students are able to discuss in small groups and develop an a	pproach.		
Autonomy	The students are able to develop a complex problem self-consiste	nt and analyse the results in a critical wa	v. A qualified exchan	ge with other students is
	given.		,,	9
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation N	lechanical Engineering, Focus Biomecha	anics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation N	lechanical Engineering, Focus Energy Sy	ystems: Compulsory	
	General Engineering Science (German program): Specialisation E	iomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation N			
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): \$	Specialisation Mechanical Engineering,	Focus Theoretical M	lechanical Engineering:
	Compulsory			
	General Engineering Science (German program, 7 semester): Spe		pulsory	
	General Engineering Science (English program): Specialisation B			
	General Engineering Science (English program): Specialisation M	* *		
	General Engineering Science (English program): Specialisation M			
	General Engineering Science (English program): Specialisation M		-	
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): S Compulsory	Specialisation Mechanical Engineering,	Focus Theoretical M	lechanical Engineering:
	General Engineering Science (English program, 7 semester): Spec	cialisation Biomedical Engineering: Com	pulsory	
	Mechanical Engineering: Specialisation Energy Systems: Compuls		· •	
	Mechanical Engineering: Specialisation Theoretical Mechanical E			

Course L0458: Heat Transfer	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Dr. Andreas Moschallski
Language	DE
Cycle	WiSe
Content	Dimensional analysis, heat conduction, convective heat transfer, Two-phase heat transfer (evaporation, condensation), thermal radiation, heat
	exchangers, measurement methods
Literature	- Herwig, H.; Moschallski, A.: Wärmeübertragung, 3. Auflage, Springer Vieweg Verlag, Wiesbaden, 2014
	- Herwig, H.: Wärmeübertragung von A-Z, Springer- Verlag, Berlin, Heidelberg, 2000
	- Baehr, H.D.; Stephan, K.: Wärme- und Stoffübertragung, 2. Auflage, Springer Verlag, Berlin, Heidelberg, 1996



Course L0459: Heat Transfer	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Andreas Moschallski
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses	
Fitle	Typ Hrs/wk CP Lecture 2 4
ntroduction to Control Systems (L0654) ntroduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2
Module Responsible	Prof. Herbert Werner
Admission Requirements	none
Recommended Previous	Representation of signals and systems in time and frequency domain, Laplace transform
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	
	 Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second orders systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.
	They can explain the role of the phase margin in analysis and synthesis of control loops
	They can explain the way a PID controller affects a control loop in terms of its frequency response
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally
Chille	
Skills	Students can transform models of linear dynamic systems from time to frequency domain and vice versa
	They can simulate and assess the behavior of systems and control loops
	They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules
	They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks
Personal Competence	
Social Competence	
Autonomy	
,	problems.
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
	macportating rates and rates and rates are a second of
Credit points	
Credit points Examination	
	6 Written exam
Examination	6 Written exam 120 min
Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering, Focus Theoretical Mechanical Engineering
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science Compulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productic
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Spe
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productive Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productive Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory General Engine
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program, 7 semester): Specialisation Compulsory General Engineering Science (English program, 7 se
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productive Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productive Compulsory General Engineering Science (Engilish program, 7 semester): Specialisation Compulsory General Engineering Sci
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productive Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ener
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 se
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Awal Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Anteriat Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering,
Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 se



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems
	Linear systems, differential equations and transfer functions
	First and second order systems, poles and zeros, impulse and step response
	Stability
	Feedback systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Root locus techniques
	Root locus plots
	Root locus design of PID controllers
	Frequency response techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation
	Frequency response interpretation of PID control
	Time delay systems
	Root locus and frequency response of time delay systems
	Smith predictor
	Digital control
	Sampled-data systems, difference equations
	Tustin approximation, digital implementation of PID controllers
	Tasan approximation, digital implementation of 12 controllers
	Software tools
	Introduction to Matlab, Simulink, Control toolbox
	Computer-based exercises throughout the course
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010



Course L0655: Introduction to Control Systems	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



	Mechanical Engineering Design			
Courses				
ïtle		Тур	Hrs/wk	СР
dvanced Mechanical Engineering Design	II (L0264)	Lecture	2	2
dvanced Mechanical Engineering Design		Recitation Section (large)	2	1
dvanced Mechanical Engineering Design		Lecture	2	2
dvanced Mechanical Engineering Design		Recitation Section (large)	2	I
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	Fundamentals of Mechanical Engineering D	Design		
Knowledge	Mechanics			
	 Fundamentals of Materials Science 			
	 Production Engineering 			
Educational Objectives	After taking part successfully at idente have reache	ed the following learning regults		
Educational Objectives	After taking part successfully, students have reache	a the following learning results		
Professional Competence	A Grand and the second development of the second se			
Knowledge	After passing the module, students are able to:			
	 explain complex working principles and fun 	ctions of machine elements and of basic elements of fluid	ics,	
	 explain requirements, selection criteria, app 	lication scenarios and practical examples of complex ma	chine elements,	
	 indicate the background of dimensioning ca 	lculations.		
21.77				
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of co	vered machine elements,		
	 transfer knowledge learned in the module to 	new requirements and tasks (problem solving skills),		
	 recognize the content of technical drawings 	and schematic sketches,		
	 evaluate complex designs, technically. 			
Paragnal Competence				
Personal Competence				
Social Competence	Students are able to discuss technical inform	mation in the lecture supported by activating methods.		
Autonomy	Students are able to independently deepen	their acquired knowledge in exercises.		
		nowledge and to recapitulate poorly understood conter	t e.g. by using the	video recordings of t
	lectures.			-
Workload in Hours	Independent Study Time 68, Study Time in Lecture	112		
Credit points	6			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): S	Specialisation Mechanical Engineering, Focus Energy Sy	stems: Compulsory	
Curricula		Specialisation Mechanical Engineering, Focus Aircraft Sys		
	General Engineering Science (German program): S	Specialisation Mechanical Engineering, Focus Materials i	n Engineering Scien	ces: Compulsory
	General Engineering Science (German program): S	Specialisation Mechanical Engineering, Focus Mechatron	ics: Compulsory	
	General Engineering Science (German program): S	Specialisation Mechanical Engineering, Focus Product De	evelopment and Prod	duction: Compulsory
		Specialisation Mechanical Engineering, Focus Theoretica	I Mechanical Engine	ering: Compulsory
	General Engineering Science (German program, 7			
	1			ngineering: Compulso
		semester): Specialisation Mechanical Engineering, Focu, 7 semester): Specialisation Mechanical Engineering,		ngineering: Compulso
	Compulsory	, 7 semester): Specialisation Mechanical Engineering,	Focus Materials in	ngineering: Compulso Engineering Science
	Compulsory General Engineering Science (German program, 7	, 7 semester): Specialisation Mechanical Engineering, semester): Specialisation Mechanical Engineering, Focu	Focus Materials in	ngineering: Compulso Engineering Science npulsory
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program,	, 7 semester): Specialisation Mechanical Engineering,	Focus Materials in	ngineering: Compulso Engineering Science npulsory
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory	, 7 semester): Specialisation Mechanical Engineering, semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu	Focus Materials in s Mechatronics: Con ocus Product Devel	ngineering: Compulso Engineering Science npulsory opment and Production
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program,	, 7 semester): Specialisation Mechanical Engineering, semester): Specialisation Mechanical Engineering, Focu	Focus Materials in s Mechatronics: Con ocus Product Devel	ngineering: Compulso Engineering Scienc npulsory opment and Production
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory	, 7 semester): Specialisation Mechanical Engineering, semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, I	Focus Materials in s Mechatronics: Conocus Product Development of the control of	ngineering: Compulso Engineering Science Inpulsory Opment and Production Mechanical Engineering
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7	, 7 semester): Specialisation Mechanical Engineering, semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focusemester): Specialisation Mechanical Engineering, Semester): Specialisation Mechanical Engineering, Focus	Focus Materials in s Mechatronics: Conocus Product Development of the Security	ngineering: Compulso Engineering Science Inpulsory Inpulsory Inpulsory Inpulsory Inpulsory Inpulsory Inpulsory Inpulsory
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7	, 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focusemester): Specialisation Mechanical Engineering, Focus	Focus Materials in s Mechatronics: Conocus Product Development of the Section 1 of the Sect	ngineering: Compulso Engineering Science Inpulsory Inpulsory Inpulsory Inpulsory Inpulsory Inpulsory Inpulsory Inpulsory
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S	, 7 semester): Specialisation Mechanical Engineering, semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, semester): Specialisation Mechanical Engineering, Focu semester): Specialisation Mechanical Engineering, Focu specialisation Mechanical Engineering, Focus Energy Systems	Focus Materials in s Mechatronics: Con ocus Product Development of the second ocus Theoretical Mes Biomechanics: Cos s Energy Systems: Cotems: Compulsory	ngineering: Compulso Engineering Science Inpulsory Opment and Production Mechanical Engineering Impulsory Compulsory
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S General Engineering Science (English program): S	, 7 semester): Specialisation Mechanical Engineering, Semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focus 7 semester): Specialisation Mechanical Engineering, Focus 8 semester): Specialisation Mechanical Engineering, Focus 8 semester): Specialisation Mechanical Engineering, Focus 9 semester): Specialisation Mechanical Engineering, Focus 9 sepecialisation Mechanical Engineering, Focus 8 sepecialisation Mechanical Engineering, Focus 9 sepecialisation Mechanical Engineering, Focus 8 september 9 s	Focus Materials in s Mechatronics: Con ocus Product Development of the second ocus Product Development of the second ocus Product Development ocus Second ocus Energy Systems: Cottems: Compulsory tems Engineering: Compulsory	ngineering: Compulso Engineering Science Inpulsory Opment and Production Mechanical Engineering Impulsory Compulsory
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S	semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focus 8 semester): Specialisation Mechanical Engineering, Focus 8 semester): Specialisation Mechanical Engineering, Focus Materials in 9 specialisation Mechanical Engineering, Focus Materials in 9 specialisation Mechanical Engineering, Focus Materials in 9 semester): Specialisation Mechanical Engineering	Focus Materials in s Mechatronics: Con ocus Product Development of the second ocus Product Development of the second ocus Product Development ocus Senergy Systems: Cottems: Compulsory tems Engineering: Cottems Engineering: Cottems Engineering: Cottems ocus Production oc	ngineering: Compulso Engineering Science Inpulsory Opment and Production Mechanical Engineering Impulsory Compulsory
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S	semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focus 8 semester): Specialisation Mechanical Engineering, Focus 8 sepecialisation Mechanical Engineering, Focus Materials in 9 specialisation Mechanical Engineering, Focus Materials in 9 specialisation Mechanical Engineering, Focus Mechanical E	Focus Materials in s Mechatronics: Con ocus Product Development of the second ocus Product Development of the second ocus Product Development ocus Energy Systems: Cottems: Compulsory tems Engineering: Cottems Engineering Sciences: Compulsory	ngineering: Compulso Engineering Science Inpulsory Opment and Production Mechanical Engineering Impulsory Compulsory Compulsory Compulsory
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S	semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focus 8 sepecialisation Mechanical Engineering, Focus Materials in 8 sepecialisation Mechanical Engineering, Focus Mechanical 8 sepecialisation Mechanical Engineering, Focus Mechanical 8 sepecialisation Mechanical Engineering, Focus Product Despecialisation Product Despecialisation Product Despecialisation Product Despecialisation	Focus Materials in s Mechatronics: Con ocus Product Development Signature of the second secon	ngineering: Compulso Engineering Science Inpulsory Opment and Production Mechanical Engineering Impulsory Compulsory Compulsory Compulsory Compulsory Compulsory
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S	semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focus Aircraft System 19 sepecialisation Mechanical Engineering, Focus Materials in 19 secialisation Mechanical Engineering, Focus Mechanical 19 secialisation Mechanical Engineering, Focus Product Despecialisation Mechanical Engineering, Focus Theoretical 19 secialisation Mechanical Engineering, Focus Theoretical 19 seminary 19 secialisation Mechanical Engineering, Focus Theoretical 19 seminary	Focus Materials in s Mechatronics: Con ocus Product Development Signature of the second ocus Product Development and Product Development and Product Development and Product Signature ocus Compulsory velopment and Product	ngineering: Compulsor Engineering Science Engineering Science Engineering Science Engineering
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S General Engineering Science (English program, 7	semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focus Aircraft System 19 sepecialisation Mechanical Engineering, Focus Materials in 19 secialisation Mechanical Engineering, Focus Mechanical 19 sepecialisation Mechanical Engineering, Focus Product Despecialisation Mechanical Engineering, Focus Theoretical 8 semester): Specialisation Mechanical Engineering, Focus Theoretical 8 semeste	Focus Materials in s Mechatronics: Con ocus Product Development Silver S	ngineering: Compulsor Engineering Science Engineering Science Engineering Science Engineering Engineer
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S General Engineering Science (English program, 7	semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focus Aircraft System 19 sepecialisation Mechanical Engineering, Focus Materials in 19 secialisation Mechanical Engineering, Focus Mechanical 19 secialisation Mechanical Engineering, Focus Product Despecialisation Mechanical Engineering, Focus Theoretical 19 secialisation Mechanical Engineering, Focus Theoretical 19 seminary 19 secialisation Mechanical Engineering, Focus Theoretical 19 seminary	Focus Materials in s Mechatronics: Con ocus Product Development Silver S	ngineering: Compulsor Engineering Science Engineering Science Engineering Science Engineering Engineer
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S General Engineering Science (English program, 7: General Engineering Science (English program, 7: General Engineering Science (English program, 7: General Engineering Science (English program, Compulsory	semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focus Aircraft System 10 sepecialisation Mechanical Engineering, Focus Materials in 10 specialisation Mechanical Engineering, Focus Product Despecialisation Mechanical Engineering, Focus Theoretical 9 semester): Specialisation Mechanical Engineering, Focus 7 seme	Focus Materials in s Mechatronics: Concus Product Development and Product Development Deve	ngineering: Compulsor Engineering Science Engineering Science Engineering Science Engineering Science Engineering Engineering Engineering: Compulsory Engineering: Compulsory Engineering: Compulsory Engineering: Science
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S General Engineering Science (English program, 7 General Engineering Science (English program, 7 General Engineering Science (English program, 7 General Engineering Science (English program, Compulsory General Engineering Science (English program, 7 General Engineering Science (English program)	semester): Specialisation Mechanical Engineering, Focus research (Specialisation Mechanical Engineering, Focus 7 semester): Specialisation Mechanical Engineering, Focus 8 semester): Specialisation Mechanical Engineering, Focus 9 semester): Specialisation Mechanical Engineering, Focus 9 sepecialisation Mechanical Engineering, Focus 9 sepecialisation Mechanical Engineering, Focus 9 semester): Specialisation Mechanical Engineering, Focus 9 semester): Specialisation Mechanical Engineering, Focus 17 semester): Specialisation Mechanical Engineering, Focus 17 semester): Specialisation Mechanical Engineering, Focus 18 semester): Specialisation Mechanical Engineering, Focus 19 semester): Spec	Focus Materials in s Mechatronics: Concus Product Development and Product Development and Product Series Compulsory tems Engineering: Concus Compulsory velopment and Products: Aircraft Systems En Focus Materials in s Mechatronics: Compulsory	ngineering: Compulsor Engineering Science Engineering Science Engineering Science Engineering Engineering Engineering Engineering Engineering: Compulsory Engineering: Compulsory Engineering: Compulsory Engineering Science
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S General Engineering Science (English program, 7 General Engineering Science (English program)	semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 7 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 8 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focu 9 semester): Specialisation Mechanical Engineering, Focus Aircraft System 10 sepecialisation Mechanical Engineering, Focus Materials in 10 specialisation Mechanical Engineering, Focus Product Despecialisation Mechanical Engineering, Focus Theoretical 9 semester): Specialisation Mechanical Engineering, Focus 7 seme	Focus Materials in s Mechatronics: Concus Product Development and Product Development and Product Series Compulsory tems Engineering: Concus Compulsory velopment and Products: Aircraft Systems En Focus Materials in s Mechatronics: Compulsory	ngineering: Compulsor Engineering Science Engineering Science Engineering Science Engineering Engineering Engineering Engineering Engineering: Compulsory Engineering: Compulsory Engineering: Compulsory Engineering Science
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S General Engineering Science (English program, 7 General Engineering Science (English program, 7 General Engineering Science (English program, Compulsory General Engineering Science (English program, 7 General Engineering Science (English prog	semester): Specialisation Mechanical Engineering, Focus research Mechanical Engineering, Focus 7 semester): Specialisation Mechanical Engineering, Focus 7 semester): Specialisation Mechanical Engineering, Focus research: Specialisation Mechanical Engineering, Focus Aircraft System of the State of	Focus Materials in s Mechatronics: Concus Product Development and Product Series and Ser	ngineering: Compulsor Engineering Science Inpulsory Inpu
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S General Engineering Science (English program, 7 Ge	semester): Specialisation Mechanical Engineering, Focus research (Specialisation Mechanical Engineering, Focus 7 semester): Specialisation Mechanical Engineering, Focus 8 semester): Specialisation Mechanical Engineering, Focus 9 semester): Specialisation Mechanical Engineering, Focus 9 sepecialisation Mechanical Engineering, Focus 9 sepecialisation Mechanical Engineering, Focus 9 semester): Specialisation Mechanical Engineering, Focus 9 semester): Specialisation Mechanical Engineering, Focus 17 semester): Specialisation Mechanical Engineering, Focus 17 semester): Specialisation Mechanical Engineering, Focus 18 semester): Specialisation Mechanical Engineering, Focus 19 semester): Spec	Focus Materials in s Mechatronics: Concus Product Development and Product Series and Ser	ngineering: Compulsor Engineering Science Engineering Science Engineering Science Engineering Engineering Engineering Engineering Engineering: Compulsory Engineering: Compulsory Engineering Science Engineering Science Engineering Science Engineering Science Engineering Engineering Engineering Science Engineering Engineering Engineering Science Engineering Engineering
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S General Engineering Science (English program, 7:	semester): Specialisation Mechanical Engineering, Focus Formula Engineering, Focus Formula Engineering, Focus Formula Engineering, Focus Formula Engineering, Focus Engineering, Engi	Focus Materials in s Mechatronics: Con ocus Product Development and Product Series and S	ngineering: Compulsor Engineering Science Inpulsory Inpu
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S General Engineering Science (English program, 7 General Engineering Science (English prog	semester): Specialisation Mechanical Engineering, Focus 7 semester): Specialisation Mechanical Engineering, Focus 7 semester): Specialisation Mechanical Engineering, Focus 8 semester): Specialisation Mechanical Engineering, Focus 9 semester): Specialisation Mechanical Engineering, Focus 9 sepecialisation Mechanical Engineering, Focus 9 sepecialisation Mechanical Engineering, Focus 9 semester): Specialisation Mechanical Engineering, Focus 9 semester): Specialisation Mechanical Engineering, Focus 17 semester): Specialisation Mechanical Engineering, Focus 17 semester): Specialisation Mechanical Engineering, Focus 18 semester): Specialisation Mechanical Engineering, Focus 19 semester): S	Focus Materials in s Mechatronics: Concus Product Development and Products: Concus Engineering: Concus Engineering: Concus Compulsory velopment and Products: Compulsory National State of Concus Products: Compulsory National State of Concus Products: C	ngineering: Compulsor Engineering Science Engineering Science Engineering Science Engineering Science Engineering Engineering Engineering Engineering: Compulsory Engineering: Compulsory Engineering Science Engineering Science Engineering Science Engineering
	Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (English program): S General Engineering Science (English program, 7 General Engineering Science (English prog	semester): Specialisation Mechanical Engineering, Focus Formula Engineering, Focus Formula Engineering, Focus Formula Engineering, Focus Formula Engineering, Focus Engineering, Engineerin	Focus Materials in s Mechatronics: Concus Product Development and Products: Concus Engineering: Concus Engineering: Concus Compulsory velopment and Products: Compulsory National State of Concus Products: Compulsory National State of Concus Products: C	ngineering: Compulsor Engineering Science Inpulsory



Course L0264: Advanced Mechanical Engineering Design II Typ Lecture Hrs/wk 2 CP 2 Workload in Hours Independent Study Time 32, Study Time in Lecture 28 Lecturer Prof. Dieter Krause, Prof. Otto von Estorff	
Hrs/wk 2 CP 2 Workload in Hours Independent Study Time 32, Study Time in Lecture 28	
CP 2 Workload in Hours Independent Study Time 32, Study Time in Lecture 28	
Workload in Hours Independent Study Time 32, Study Time in Lecture 28	
- 3.3.3	
Cycle SoSe	
Content Advanced Mechanical Engineering Design I & II	
Lecture	
Fundamentals of the following machine elements:	
Linear rolling bearings	
Axes & shafts	
Seals	
Clutches & brakes	
Belt & chain drives	
Gear drives	
Epicyclic gears	
Crank drives	
Sliding bearings	
Elements of fluidics	
Exercise	
Exercise	
Calculation methods of the following machine elements:	
 Linear rolling bearings 	
Axes & shafts	
Clutches & brakes	
Belt & chain drives	
Gear drives	
Epicyclic gears	
Crank gears	
Sliding bearings	
Calculations of hydrostatic systems (fluidics)	
Literature	
Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Spr	ringer-Verlag, aktuelle Auflage.
Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.	
 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag 	g, aktuelle Auflage.
 Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. 	
 Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. 	
Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.	
Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bode	enstein, F., Springer-Verlag, aktuelle Auflage.
Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Spri	ringer Vieweg, aktuelle Auflage.
Sowie weitere Bücher zu speziellen Themen	

Course L0265: Advanced Mechanical Engineering Design II	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0262: Advanced Mechanic	al Engineering Design I
	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	Advanced Mechanical Engineering Design I & II
Content	Advanced Mechanical Engineering Design Facility
	Lecture
	Fundamentals of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Seals
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank drives
	 Sliding bearings
	Elements of fluidics
	Exercise
	Calculation methods of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	• Crank gears
	Sliding bearings
	Calculations of hydrostatic systems (fluidics)
Literature	
	 Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Bücher zu speziellen Themen
	COMIC MOTION DUGINE 20 SPECIONENT FIRMING

Course L0263: Advanced Mechanical Engineering Design I	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0655: Computation	onal Fluid Dynamics I			
Courses				
Title		Тур	Hrs/wk	CP
Computational Fluid Dynamics I (L0235) Computational Fluid Dynamics I (L0419)		Lecture Recitation Section (large)	2	3
Module Responsible	Prof. Thomas Rung	riecitation dection (large)	2	3
Admission Requirements	None			
Recommended Previous	None			
Knowledge	 Mathematical Methods for Engineers 			
ouge	 Fundamentals of Differential/integral calculus and series expansion 	ansions		
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence	The landing part successionly, stadents have reastled the following to	arming rosans		
Knowledge	The students are able to list the basic numerics of partial differential of	equations		
, and medge	The state in are able to her the basic numerics of partial and on the	34444		
Skills	The students are able develop appropriate numerical integration	in space and time for the governing	partial differential ed	nuations. They can code
	computational algorithms in a structured way.			,
Personal Competence				
Social Competence	The students can arrive at work results in groups and document them	1.		
Autonomy	The students can independently analyse approaches to solving spec	cific problems.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	2h			
Assignment for the Following	General Engineering Science (German program): Specialisation Med	chanical Engineering, Focus Energy S	Systems: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Nav	val Architecture: Compulsory		
	General Engineering Science (German program, 7 semester): Specia	alisation Naval Architecture: Compulse	ory	
	General Engineering Science (German program, 7 semester): Specia	-	cus Energy Systems: E	Elective Compulsory
	General Engineering Science (English program): Specialisation Nav			
	General Engineering Science (English program): Specialisation Med			
	General Engineering Science (English program, 7 semester): Specia	•	•	The allies Or and I
	General Engineering Science (English program, 7 semester): Specia	uisation Mechanical Engineering, Foc	us ⊨nergy Systems: E	elective Compulsory
	Naval Architecture: Core qualification: Compulsory Technomathematics: Specialisation III. Engineering Science: Elective	- Compulsory		
	Technomathematics: Specialisation III. Engineering Science: Elective			
	The state of the s			

Course L0235: Computational Fluid Dynamics I	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Thomas Rung
Language	DE
Cycle	WiSe
Content	Fundamentals of computational modelling of thermofluid dynamic problems. Development of numerical algorithms.
	Partial differential equations Foundations of finite numerical approximations
	3. Computation of potential flows 4. Introduction of finite-differences 5. According to a factor of the state of the st
	Approximation of convective, diffusive and transient transport processes Formulation of boundary conditions and initial conditions Assembly and solution of algebraic equation systems
	8. Facets of weighted -residual approaches 9. Finite volume methods 10. Basics of grid generation
Literature	Ferziger and Peric: Computational Methods for Fluid Dynamics, Springer



Course L0419: Computational Fluid Dynamics I	
Тур	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Thomas Rung
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0639: Gas and Ste	eam Power Plants			
Courses				
Title		Тур	Hrs/wk	СР
Gas and Steam Power Plants (L0206)		Lecture	3	4
Gas and Steam Power Plants (L0210)		Recitation Section (large)	2	2
Module Responsible	Prof. Alfons Kather			
Admission Requirements	None			
Recommended Previous				
Knowledge	"Technical Thermodynamics I and II" "Illast Taxasfar"			
	"Heat Transfer" "Fluid Mechanics"			
	1 Tala Westanies			
Educational Objectives	After taking part successfully, students have reached the following	owing learning results		
Professional Competence				
Knowledge	The students can evaluate the development of the electricity	demand and the energy conversion routes in	n the thermal power p	lant, describe the vario
	types of power plant and the layout of the steam generato			
	Additionally they can describe the exhaust gas cleaning ap		f conventional fossil-	fuelled power plants v
	solar thermal and geothermal power plants or plants equipped	ed with Carbon Capture and Storage.		
	The students have basic knowledge about the principles, open	eration and design of turbomachinery		
Skills	The students will be able, using theories and methods of the	e energy technology from fossil fuels and bas	ed on well-founded k	nowledge on the funct
	and construction of gas and steam power plants, to identify			
	solutions. Through analysis of the problem and exposure to	the inherent interplay between heat and po-	wer generation the st	udents are endowed v
	the capability and methodology to develop realistic optimal c	oncepts for the generation of electricity and the	ne production of heat.	From the technical bas
	the students become the ability to follow better the deliberat	ions on the electricity mix composition within	the energy-political t	riangle (economy, sec
	supply and environmental protection).			
	Within the framework of the exercise the students learn the u	use of the appointing authors quite EPSILO	N BrafassianalTM Wi	th this tool small prost
	tasks are solved with the PC, to highlight aspects of the design		in Fiolessional . Wi	ur uns toor sman pract
	tasks are solved with the FO, to highlight aspects of the desig	in and development of power plant by clos.		
	The students are able to do simplified calculations on turbom	nachinery either as part of a plant, as single co	omponent or at stage	level.
Personal Competence				
Social Competence	An excursion within the framework of the lecture is planned to	for students that are interested. The students	get in this manner dir	ect contact with a mod
	power plant in this region. The students will obtain first-har	nd experience with a power plant in operation	on and gain insights i	nto the conflicts between
	technical and political issues.			
Autonomy	The students assisted by the tutors will be able to develop $% \left\{ 1,2,\ldots ,n\right\}$	alone simple simulation models and run wit	th these scenario ana	alyses. In this manner
	theoretical and practical knowledge from the lecture is co	onsolidated and the potential effects from	different process con	nbinations and bound
	conditions highlighted. The students are able independent	tly to analyse the operational performance	of steam power plan	ts and calculate selec
	quantities and characteristic curves.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination				
Examination duration and scale	Written examination of 120 min			
Assignment for the Following	General Engineering Science (German program): Specialisa	**		
Curricula	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program, 7 semester	, ,	0 0 1	,
	General Engineering Science (German program, 7 semester		cus Energy Systems:	Elective Compulsory
	Energy and Environmental Engineering: Core qualification: 0	Joinpuisory		
	Conoral Engineering Science (English program), Consideration	tion Engray and Environmental Engineering	ompulcony	
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program): Specialisat	tion Mechanical Engineering, Focus Energy S	Systems: Compulsory	ov.
		tion Mechanical Engineering, Focus Energy S : Specialisation Energy and Enviromental En	Systems: Compulsory gineering: Compulsor	



Course L0206: Gas and Steam Pow	er Plants
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Alfons Kather
Language	DE
Cycle	WiSe
Content	In the 1 st part of the lecture an overview on thermal power plants is offered, including:
	Electricity demand and Forecasting
	Thermodynamic fundamentals
	Energy Conversion in thermal power plants
	Types of power plant
	Layout of the power plant block
	Individual elements of the power plant
	Cooling systems
	Flue gas cleaning
	Operation characteristics of the power plant
	Construction materials for power plants
	Location of power plants
	Solar thermal plants/geothermal plants/Carbon Capture and Storage plants.
	These are complemented in the 2 nd part of the module by the more specialised issues:
	Energy balance of a turbomachine
	Theory of turbine and compressor stage
	Equal and positive pressure blading
	Flow losses
	Characteristic numbers
	Axial and radial design
	Design features
	Hydraulic turbomachines
	Pump and water turbine designs
	Design examples of reciprocating engines and turbomachinery
	Steam power plants
	Gas turbine systems.
Literature	Kalide: Kraft- und Arbeitsmaschinen
	Nalide: Krail- und Arbeitsmaschinen Thomas, H.J.: Thermische Kraftanlagen. Springer-Verlag, 1985
	Thomas, H.J.: Thermische Krallanlagen. Springer-Verlag, 1985 Strauß, K.: Kraftwerkstechnik. Springer-Verlag, 2006
	Straub, K.: Kratiwerkstechnik. Springer-verlag, 2006 Kugeler und Phlippen: Energietechnik. Springer-Verlag, 1990
	 Rugeler und Prilippen: Energielectrink. Springer-Verlag, 1990 Bohn, T. (Hrsg.): Handbuchreihe Energie, Band 7: Gasturbinenkraftwerke, Kombikraftwerke, Heizkraftwerke und Industriekraftwerke, Technischer
	Verlag Resch / Verlag TÜV Rheinland
	- only 1000 tong 10 t intolliging



Тур	Desilation Continue (Louis)
	Recitation Section (large)
	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Alfons Kather
Language	DE
Cycle	WiSe
Content	In the 1 st part of the lecture a general introduction into fluid-flow machines and steam power plants is offered, including:
	a. Energy belongs of a fluid flay moshing
	Energy balance of a fluid-flow machine The asy of the big and a stranger and a second and a stranger and a second and a stranger and a second
	Theory of turbine and compressor stage
	Equal and positive pressure blading
	• Flow losses
	Characteristic numbers
	Axial and radial design
	Design features
	Hydraulic fluid-flow machines
	Pump and water turbine designs
	Design examples of reciprocating engines and turbomachinery
	Steam power plants
	Gas turbine systems
	Diesel engine systems
	Waste heat utilisation
	followed by the more specialised issues:
	Electricity Demand and Forecasting
	Thermodynamic fundamentals
	Energy Conversion in Thermal Power Plants
	Types of Power Plant
	Layout of the power plant block
	Individual elements of the power plant
	Cooling systems
	Flue gas cleaning
	Operation characteristics of the power plant
	Construction materials Location of power plants
	The environmental impact of acidification, fine particulate or CO ₂ emissions and the resulting climatic effects are a special focus of the lecture an
	lecture hall exercise. The challenges in plant operation from interconnecting conventional power plants and renewable energy sources are discu
	and the technical options for providing security of supply and network stability are presented, also under consideration of cost effectiveness. In
	critical review, focus is especially placed on the compatibility of the different solutions with the environment and climate. With this, the awareness for
	responsibility of an engineer's own actions are emphasized and the potential extent of the different solutions presented clearly.
	Within the framework of the exercise the students learn the use of the specialised software suite EBSILON Professional TM. With this tool small task
	solved on the PC, to highlight aspects of the design and development of power plant cycles. The students present their results orally and can afterw
	ask questions and get feedback. The course work has a positive effect on the students final grade.
Literature	Skripte
	Kalide: Kraft- und Arbeitsmaschinen
	Thomas, H.J.: Thermische Kraftanlagen. Springer-Verlag, 1985
	Strauß, K.: Kraftwerkstechnik. Springer-Verlag, 2006



Module M1022: Reciprocat	ing Machinery			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Reciprocating Engines a	nd Turbomachinery - Part Reciprocating Engines (L0633)	Lecture	1	1
	nd Turbomachinery - Part Reciprocating Engines (L0634)	Recitation Section (large)	1	1
Internal Combustion Engines I (L0059)		Lecture	2	2
Internal Combustion Engines I (L0639)		Recitation Section (large)	1	2
Module Responsible	Prof. Christopher Friedrich Wirz			
Admission Requirements	None			
Recommended Previous	Thermodynamics, Mechanics, Machine Elements			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge Skills	machinery and describe the qualitative and quantitative correlations of operating methods and efficiencies of multiple types of engines, compressors and pumps. They are able to utilize technical terms and parameters as well as aspects regarding the development of power density and efficiency, furthermore to give an overview of charging systems, fuels and emissions. The students are able to select specific types of machinery and assess design related and operational problems. As a result of the part module "Internal Combustion Engines I", the students are able reflect and utilize the state-of-the-art regarding efficiency limits. In addition, they are able to utilize their knowledge of design, mechanical and thermodynamic characteristics and the approach of similarity. They are able to explain, assess and develop engines as well as charging systems. Detailed knowledge is present regarding computer-aided process design.			
Personal Competence Social Competence Autonomy	The students are able to communicate and cooperate in a professional environment in the field of machinery design and application. The widespread scope of gained knowledge enables the students to handle situations in their future profession independently and confidently.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation M	Mechanical Engineering, Focus Energy	Systems: Compulsory	
Curricula	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering, Fo	cus Energy Systems:	Compulsory
	General Engineering Science (English program): Specialisation M	lechanical Engineering, Focus Energy S	Systems: Compulsory	
	General Engineering Science (English program, 7 semester): Spe	cialisation Mechanical Engineering, Foo	cus Energy Systems: (Compulsory
	Mechanical Engineering: Specialisation Energy Systems: Compul	con		



Course L0633: Fundamentals of Re	ciprocating Engines and Turbomachinery - Part Reciprocating Engines
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Christopher Friedrich Wirz
Language	DE
Cycle	WiSe
Content	Verbrennungsmotoren Historischer Rückblick Einteilung der Verbrennungsmotoren Arbeitsverfahren Vergleichsprozesse Arbeit, Mitteldrücke, Leistungen Arbeitsprozess des wirklichen Motors Wirkungsgrade Gemischbildung und Verbrennung Motorkennfeld und Betriebskennlinien Abgasentgiftung Gaswechsel Aufladung Kühl- und Schmiersystem Kräfte im Triebwerk
	Thermodynamik des Kolbenverdichters Einteilung und Verwendung Kolbenpumpen Prinzip der Kolbenpumpen
Literature	Einteilung und Verwendung A. Urlaub: Verbrennungsmotoren W. Kalide: Kraft- und Arbeitsmaschinen

Course L0634: Fundamentals of Re	Course L0634: Fundamentals of Reciprocating Engines and Turbomachinery - Part Reciprocating Engines	
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Christopher Friedrich Wirz	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0059: Internal Combustion	Course L0059: Internal Combustion Engines I	
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Wolfgang Thiemann	
Language	DE	
Cycle	SoSe	
Content	The beginnings of engine development Design of of motors Real process calculation Charging methods Kinematics of the crank mechanism Forces in the engine	
Literature	Vorlesungsskript Übungsaufgaben mit Lösungsweg Literaturliste	



Course L0639: Internal Combustion Engines I	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Wolfgang Thiemann
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



ourses				
tle		Тур	Hrs/wk	CP
roduction to Management (L0880)		Lecture	3	3
oject Entrepreneurship (L0882)	Draf Christoph Ibl	Problem-based Learning	2	3
Module Responsible	Prof. Christoph IhI None			
Admission Requirements Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge	basic Mowledge of Mathematics and business			
Educational Objectives	After taking part successfully, students have reached the following le	earning results		
Professional Competence	, , , , , , , , , , , , , , , , , , ,			
Knowledge	After taking this module, students know the important basics of ma	ny different areas in Business and Mar	nagement, from Plani	ning and Organisation
	Marketing and Innovation, and also to Investment and Controlling. In	n particular they are able to		
	explain the differences between Economics and Manageme	ent and the sub-disciplines in Manageme	ent and to name impo	ortant definitions from t
	field of Management	int and the sub-disciplines in Manageria	ent and to name impo	mani dell'illions iloni i
	explain the most important aspects of and goals in Manager	nent and name the most important aspe	cts of entreprneurial	projects
	describe and explain basic business functions as productions.			
	ressource management, information management, innovation			
	explain the relevance of planning and decision making in	Business, esp. in situations under mul	Itiple objectives and	uncertainty, and expla
	some basic methods from mathematical Finance			
	state basics from accounting and costing and selected contr	olling methods.		
Skills	Students are able to analyse business units with respect to	different criteria (organization objec	tives strategies etc) and to carry out
Onno	Entrepreneurship project in a team. In particular, they are able to	different criteria (organization, objec	aves, strategies etc	, and to carry out
	analyse Management goals and structure them appropriatel	у		
	analyse organisational and staff structures of companies			
	apply methods for decision making under multiple objectives.			
	analyse production and procurement systems and Business	information systems		
	analyse and apply basic methods of marketing	and the state of t		
	select and apply basic methods from mathematical finance t apply basic methods from accounting and controlling			
	 apply basic methods from accounting, costing and controllin 	g to predefined problems		
Personal Competence				
Social Competence	Students are able to			
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepreneur	ship project and write a coherent report	on the project	
	to communicate appropriately and	ship project and write a conferent report	on the project	
	to confind the appropriately and to cooperate respectfully with their fellow students.			
	to desperate respectant, mar area renew discorde.			
Autonomy	Students are able to			
	work in a team and to organize the team themselves			
	to write a report on their project.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation Ele	ectrical Engineering: Compulsory		
Curricula				
	General Engineering Science (German program): Specialisation Pr			
	General Engineering Science (German program): Specialisation Bio			
	General Engineering Science (German program): Specialisation Er			
	General Engineering Science (German program): Specialisation Ci		привогу	
	General Engineering Science (German program): Specialisation Me	echanical Engineering: Compulsory	пригосту	
	General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Bio	echanical Engineering: Compulsory omedical Engineering: Compulsory	привогу	
	General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Bi General Engineering Science (German program): Specialisation Na	echanical Engineering: Compulsory omedical Engineering: Compulsory aval Architecture: Compulsory		
	General Engineering Science (German program): Specialisation Ma General Engineering Science (German program): Specialisation Bi General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Specialisation Na	echanical Engineering: Compulsory omedical Engineering: Compulsory aval Architecture: Compulsory ialisation Electrical Engineering: Compi	ulsory	
	General Engineering Science (German program): Specialisation Mo General Engineering Science (German program): Specialisation Bio General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Specialisation Specialisation Na	echanical Engineering: Compulsory omedical Engineering: Compulsory aval Architecture: Compulsory ialisation Electrical Engineering: Compu ialisation Process Engineering: Compu	ulsory Isory	
	General Engineering Science (German program): Specialisation Ma General Engineering Science (German program): Specialisation Bi General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Specialisation Na	echanical Engineering: Compulsory or medical Engineering: Compulsory aval Architecture: Compulsory ialisation Electrical Engineering: Compulation Process Engineering: Compulatisation Biomedical Engineering: Compulatisation Biomedical Engineering: Compu	ulsory Isory ipulsory	
	General Engineering Science (German program): Specialisation McGeneral Engineering Science (German program): Specialisation Bid General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Spec	echanical Engineering: Compulsory or medical Engineering: Compulsory aval Architecture: Compulsory ialisation Electrical Engineering: Compulalisation Process Engineering: Compulalisation Biomedical Engineering: Compulalisation Naval Architecture: Compulsor	ulsory Isory npulsory rry	
	General Engineering Science (German program): Specialisation McGeneral Engineering Science (German program): Specialisation Bid General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Spec	echanical Engineering: Compulsory or medical Engineering: Compulsory aval Architecture: Compulsory ialisation Electrical Engineering: Compulsialisation Process Engineering: Compulsialisation Biomedical Engineering: Comi	ulsory Isory npulsory ory	
	General Engineering Science (German program): Specialisation McGeneral Engineering Science (German program): Specialisation BicGeneral Engineering Science (German program): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Eng	echanical Engineering: Compulsory omedical Engineering: Compulsory aval Architecture: Compulsory ialisation Electrical Engineering: Compulsisation Process Engineering: Computalisation Biomedical Engineering: Comitalisation Naval Architecture: Compulso ialisation Computer Science: Compulso ialisation Bioprocess Engineering: Com	ulsory Isory ipulsory ory ipulsory	
	General Engineering Science (German program): Specialisation McGeneral Engineering Science (German program): Specialisation BicGeneral Engineering Science (German program): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature German program, 7 semester): Specialis	echanical Engineering: Compulsory omedical Engineering: Compulsory aval Architecture: Compulsory ialisation Electrical Engineering: Compulsory ialisation Process Engineering: Compulsalisation Biomedical Engineering: Comialisation Naval Architecture: Compulso ialisation Computer Science: Compulso ialisation Bioprocess Engineering: Comialisation Civil Engineering: Compulsorialisation Civil Engineering: Compulsor	ulsory Isory ipulsory ory ory ipulsory	y
	General Engineering Science (German program): Specialisation Mic General Engineering Science (German program): Specialisation Bic General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec	echanical Engineering: Compulsory omedical Engineering: Compulsory aval Architecture: Compulsory ialisation Electrical Engineering: Compulsation Process Engineering: Compulsation Biomedical Engineering: Compulsation Naval Architecture: Compulso ialisation Computer Science: Compulso ialisation Bioprocess Engineering: Compulsatialisation Bioprocess Engineering: Compulsor ialisation Civil Engineering: Compulsor ialisation Energy and Enviromental Engineering: Compulsor ialisation Energy and Enviromental Engineering: Compulsor	ulsory Isory apulsory ory apulsory y gineering: Compulsor	
	General Engineering Science (German program): Specialisation McGeneral Engineering Science (German program): Specialisation Bic General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Spec	echanical Engineering: Compulsory omedical Engineering: Compulsory aval Architecture: Compulsory ialisation Electrical Engineering: Compulsation Process Engineering: Compulsation Biomedical Engineering: Compulsation Naval Architecture: Compulsation Computer Science: Compulsation Bioprocess Engineering: Compulsation Bioprocess Engineering: Compulsation Civil Engineering: Compulsorialisation Civil Engineering: Compulsorialisation Energy and Enviromental Engialisation Mechanical Engineering, Focialisation Mechanical Enginee	ulsory Isory pulsory ory pulsory y gineering: Compulsor us Mechatronics: Cor	npulsory
	General Engineering Science (German program): Specialisation McGeneral Engineering Science (German program): Specialisation Bic General Engineering Science (German program): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Sp	echanical Engineering: Compulsory omedical Engineering: Compulsory aval Architecture: Compulsory italisation Electrical Engineering: Compulsation Process Engineering: Compulsation Biomedical Engineering: Compulsation Naval Architecture: Compulsation Computer Science: Compulsation Bioprocess Engineering: Compulsation Bioprocess Engineering: Compulsation Civil Engineering: Compulsation Civil Engineering: Compulsation Energy and Environmental Engialisation Mechanical Engineering, Focialisation Mechanical Engineering	ulsory Isory Ipulsory Iry Inpulsory Inpulsory Igineering: Compulsor Ius Mechatronics: Cor Ius Biomechanics: Co	npulsory mpulsory
	General Engineering Science (German program): Specialisation McGeneral Engineering Science (German program): Specialisation Bit General Engineering Science (German program): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Sp	echanical Engineering: Compulsory omedical Engineering: Compulsory aval Architecture: Compulsory italisation Electrical Engineering: Compulsation Process Engineering: Compulsation Biomedical Engineering: Compulsatisation Naval Architecture: Compulsatisation Computer Science: Compulsatisation Bioprocess Engineering: Compulsatisation Engineering: Compulsor italisation Civil Engineering: Compulsor italisation Energy and Enviromental Engialisation Mechanical Engineering, Focialisation Mechanical Engineering	ulsory Isory Ipulsory Ory Ipulsory Ipul	npulsory mpulsory ngineering: Compulso
	General Engineering Science (German program): Specialisation Michael Engineering Science (German program): Specialisation Bid General Engineering Science (German program): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Nature General Engineering Science (German program, 7 semester): Specialisation Spec	echanical Engineering: Compulsory omedical Engineering: Compulsory aval Architecture: Compulsory italisation Electrical Engineering: Compulsation Process Engineering: Compulsation Biomedical Engineering: Compulsatisation Naval Architecture: Compulsatisation Computer Science: Compulsatisation Bioprocess Engineering: Compulsatisation Engineering: Compulsor italisation Civil Engineering: Compulsor italisation Energy and Enviromental Engialisation Mechanical Engineering, Focialisation Mechanical Engineering	ulsory Isory Ipulsory Ory Ipulsory Ipul	npulsory mpulsory ngineering: Compulso



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compute

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester); Specialisation Computer Science; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester); Specialisation Mechanical Engineering, Focus Biomechanics; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 ${\bf Mechanical\ Engineering:\ Core\ qualification:\ Compulsory}$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Tun	Lecture	
Typ	3	
Hrs/wk		
	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	rof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgar	
Lammana	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona DE	
Language	WiSe/SoSe	
Cycle	WISE/SOSE	
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects 	
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008	
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003	
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.	
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.	
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.	
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.	
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.	

Course L0882: Project Entrepreneurship		
Тур	Problem-based Learning	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke	
Language	DE	
Cycle	WiSe/SoSe	
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,	
	using their knowledge from the corresponding lecture.	
	Project work is carried out in teams with the support of a mentor.	
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.	



Module M0618: Renewable	s and Energy Systems			
Courses				
Title		Тур	Hrs/wk	CP
Power Industry (L0316)		Lecture	1	1
Energy Systems and Energy Industry (L0)	315)	Lecture	2	2
Renewable Energy (L0313)		Lecture	2	2
Renewable Energy (L1434)		Recitation Section (small)	1	1
Module Responsible	Prof. Martin Kaltschmitt			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ving learning results		
Professional Competence				
Knowledge	With completion of this module, the students can provide a	n overview of characteristics of energy s	ystems and their econd	mic efficiency. They can
	explain the issues occurring in this context. Furthermore, they	can explain details of power generation,	power distribution and	power trading wih regard
	to subject-related contexts. The students can explain these a	spects, which are applicable to many ene	rgy systems in general,	especially for renewable
	energy systems and critical discuss them. Furthermore, the stu	idents can explain the environmental ben-	efits from the use of such	systems.
Skills	Students are able to apply methodologies for detailed dete	rmination of energy demand or energy	production for various t	voes of energy systems.
	Furthermore, they can evaluate energy systems technically			
	Therefore, they can choose the necessary subject-specific cal			sortam given conditions.
	Therefore, they can choose the necessary subject-specific car	culation rules, also for not standardized st	nutions of a problem.	
	The students are able to explain questions and possible app	roaches to its processing from the field of	renewable energies ora	ally and to put them them
	into the right context.			
Personal Competence				
Social Competence	The students are able to analyze suitable technical alter	natives and to assess them with techn	ical, economical and	ecological criteria under
	sustainability aspects. This allows them to make an effective c	ontribuition to a more sustainable power s	supply.	
4.4	Otalia da cara fada cara da di cara da Santa da Cara d	and a standard and a standard and the standard and a standard and		
Autonomy	Students can independently exploit sources , acquire the parti	cular knowledge about the subject area a	nd transform it to new qu	iestions.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	3 hours written exam			
Assignment for the Following	General Engineering Science (German program): Specialisati	on Energy and Environmental Engineering	· Compulsory	
Curricula	General Engineering Science (German program, 7 semester):			rv
Curricula	General Engineering Science (German program, 7 semester).			•
			ocus Energy Systems: I	Liective Compulsory
	Energy and Environmental Engineering: Core qualification: Core and Engineering Colored (Facility and Engineering)	•	0	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering, F	ocus Energy Systems: E	Elective Compulsory
	General Engineering Science (English program, 7 semester): General Engineering Science (English program, 7 semester):	Specialisation Energy and Enviromental I	Engineering: Compulsor	

Course L0316: Power Industry			
Тур	Lecture		
Hrs/wk			
СР	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Prof. Martin Kaltschmitt, Dr. Andreas Wiese		
Language	DE		
Cycle	SoSe		
Content	 Electrical energy in the energy system Demand and use of electrical energy (households, industry, "new" buyers (including e-mobility)) Electricity generation electricity generation technologies using fossil fuels and their characteristics combined heat and power technologies and their production characteristics electricity generation from renewable energy technologies and their characteristics Power distribution "classic" distribution of electrical energy challenges of fluctuating electricity generation by distributed systems (electricity market, electricity stock exchange, emissions trading) District heating industry Legal and administrative aspects Energy Act support instruments for renewable energy CHP Act Cost and efficiency calculation 		
Literature	Folien der Vortesung		



Course L0315: Energy Systems and Energy Industry		
Тур	ecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Martin Kaltschmitt	
Language	DE	
Cycle	SoSe	
Content	Energy: development and significance Fundamentals and basic concepts Energy demand and future trends (heat, electricity, fuels) Energy reserve and sources Cost and efficiency calculation Final and effective energy from petroleum, natural gas, coal, uranium and other Legal, administrative and organizational aspects of energy systems Energy systems as a permanent optimization task	
Literature	Kopien der Folien	

Course L0313: Renewable Energy			
Тур	ecture		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Martin Kaltschmitt		
Language	DE/EN		
Cycle	SoSe		
Content	 introduction solar energy for heat and power generation wind power for electricity generation hydropower for electricity generation ocean energy for electricity generation geothermal energy for heat and electricity generation 		
Literature	 Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2006, 4. Auflage Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Renewable Energy - Technology, Economics and Environment; Springer, Berlin, Heidelberg, 2007 		

Course L1434: Renewable Energy		
Тур	Recitation Section (small)	
Hrs/wk		
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Martin Kaltschmitt	
Language	DE/EN	
Cycle	SoSe	
Content	Students work on different tasks in the field of renewable energies. They present their solutions in the exercise lesson and discuss it with other students	
1 throaten	and the lecturer. Possible tasks in the field of renewable energies are: Solar thermal heat Concentrating solare power Photovoltaic Windenergie Hydropower Heat pump Deep geothermal energy	
Literature	 Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2006, 4. Auflage Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Renewable Energy - Technology, Economics and Environment; Springer, Berlin, Heidelberg, 2007 	



Focus Aircraft Systems Engineering

The area of specialization "Aircraft System Engineering" prepares participating students for diverse kind of professions in the field of aviation and related industries. Students learn how to use typical methods of systems engineering as well as the application of modern, computer-based techniques for system design, analysis and evaluation. Furthermore required knowledge from different fields of aviation including aircraft systems and air transportation system is discussed.

Additionally students get insight into current research activities, e.g. in the area of fuel cells and electrical energy supply, actuators, avionics systems and software or hydraulic energy supply.

Module M0507: Advanced	Monhanian Engineering Decision			
Module M0597: Advanced	Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	CP
Advanced Mechanical Engineering Design	II (L0264)	Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design	I (L0263)	Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous				
Knowledge	 Fundamentals of Mechanical Engineering Design 			
Kilowiedge	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	 explain complex working principles and functions of m 	achine elements and of basic elements of fluid	dics,	
	 explain requirements, selection criteria, application sc 	enarios and practical examples of complex ma	achine elements,	
	 indicate the background of dimensioning calculations. 			
Skills	After passing the module, students are able to:			
	 accomplish dimensioning calculations of covered made 	chine elements		
	transfer knowledge learned in the module to new requ			
	recognize the content of technical drawings and scher	nalic sketches,		
	evaluate complex designs, technically.			
Personal Competence				
Social Competence				
oodal competence	 Students are able to discuss technical information in the 	ne lecture supported by activating methods.		
Autonomy	Students are able to independently deepen their acqu	ired knowledge in exercises		
	Students are able to acquire additional knowledge		nt e.a. hv usina the	video recordings of
	lectures.	and to recapitatate poorly anderstood come	in o.g. by doing the	video recordings or
	lectures.			
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Specialisat	ion Mechanical Engineering, Focus Energy Sy	stems: Compulsory	
Curricula	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisat	ion Mechanical Engineering, Focus Materials	in Engineering Scier	nces: Compulsory
	General Engineering Science (German program): Specialisat	ion Mechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (German program): Specialisat	ion Mechanical Engineering, Focus Product D	evelopment and Pro	duction: Compulsory
	General Engineering Science (German program): Specialisat	ion Mechanical Engineering, Focus Theoretica	al Mechanical Engine	eering: Compulsory
	General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering, Foci	us Aircraft Systems E	ngineering: Compulso
	General Engineering Science (German program, 7 semes	ter): Specialisation Mechanical Engineering	, Focus Materials ir	Engineering Science
	Compulsory	,		5 5 5 5 6 6 6
	General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering Foci	is Mechatronics: Cor	moulsory
	General Engineering Science (German program, 7 semester)			
		. Specialisation Mechanical Engineering, 1	ocus Froduct Devel	opinent and Froducti
	Compulsory	only Consisting March 21 1 5 1	Francis Theory of the	Anahani - 1 E 1 :
	General Engineering Science (German program, 7 semest	er): Specialisation Mechanical Engineering,	rucus Ineoretical N	viecnanicai Engineeri
	Compulsory			
	General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering, Foci	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering, Focu	us Energy Systems: 0	Compulsory
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Energy Sy	stems: Compulsory	
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Aircraft Sys	stems Engineering: 0	Compulsory
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Materials i	n Engineering Scien	ces: Compulsory
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program): Specialisati			duction: Compulsory
			•	
	General Engineering Science (English program): Specialisati		-	
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semes	ter): Specialisation Mechanical Engineering,	rocus Materials in	ı ⊨ngıneering Sciend
	Compulsory			



General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

Compulsory

General Engineering, Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Mechanical Engineering: Core qualification: Compulsory

Naval Architecture: Core qualification: Compulsory

Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours		
	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	SoSe	
Content	Advanced Mechanical Engineering Design I & II	
	Lecture	
	Fundamentals of the following machine elements:	
	Linear rolling bearings	
	Axes & shafts	
	Seals	
	Clutches & brakes	
	Belt & chain drives	
	• Gear drives	
	Epicyclic gears	
	Crank drives	
	Sliding bearings Elements of fluiding.	
	Elements of fluidics	
	Exercise	
	Calculation methods of the following machine elements:	
	Linear rolling bearings	
	Axes & shafts	
	Clutches & brakes	
	Belt & chain drives	
	Gear drives	
	Epicyclic gears	
	• Crank gears	
	Sliding bearings	
	Calculations of hydrostatic systems (fluidics)	
Literature	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.	
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.	
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.	
	 Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. 	
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.	
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.	
	 Maschinenellemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. 	
	 Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage. 	

Course L0265: Advanced Mechanical Engineering Design II		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Sowie weitere Bücher zu speziellen Themen



Course L0262: Advanced Mechanic	Course L0262: Advanced Mechanical Engineering Design I				
	Lecture				
Hrs/wk	2				
CP	2				
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28				
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff				
Language	DE				
Cycle	WiSe				
Content	Advanced Mechanical Engineering Design I & II				
	Lecture				
	Fundamentals of the following machine elements:				
	Linear rolling bearings				
	Axes & shafts				
	Seals				
	Clutches & brakes				
	Belt & chain drives				
	Gear drives				
	Epicyclic gears				
	Crank drives				
	Sliding bearings				
	Elements of fluidics				
	Exercise				
	Calculation methods of the following machine elements:				
	Calculation fletilods of the following flactime elements. Linear rolling bearings				
	Axes & shafts				
	Clutches & brakes				
	Belt & chain drives				
	Gear drives				
	Epicyclic gears				
	Crank gears Cliding begings				
	Sliding bearings Calculations of hydrostatic systems (fluidics)				
	• Calculations of Hydrostatic systems (indicis)				
Literature	Dubbel Teacherhark (Tealer Marchinerham) Orde V. H. Faldharen, 1912 V. O. Array Materials (H. A. Gara				
	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Maschine alle Auflage.				
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.				
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Til Til Land Line (1998) Auf Technology (1998)				
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. Voorstrildingliches Bald C. Beite W. Origons Volden althalle Auften.				
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. Masshipper langer 1. 0: Schleget B. Pagers a Verlag, aktuelle Auflage. Masshipper langer 1. 0: Schleget B. Pagers a Verlag, aktuelle Auflage.				
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. Machinenelemente Octobbre Brenchen August der Haberberg Handler in Debenden 5 German Verlag auf der Handler in Debenden 5				
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.				
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.				
	Sowie weitere Bücher zu speziellen Themen				

Course L0263: Advanced Mechanical Engineering Design I		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



ourses					
tle		Tun	Hrs/wk	CP	
		Typ Lecture	Hrs/wk	4 4	
gnals and Systems (L0432) gnals and Systems (L0433)		Recitation Section (large)	1	2	
Module Responsible	Prof. Gerhard Bauch		-		
Admission Requirements	None				
Recommended Previous	Mathematics 1-3				
Knowledge	Walternation 1 0				
	The modul is an introduction to the theory of signals and systems. (Further experience with spectral transformations (Fourier series, Four			nematik 1-3 is expe	
Educational Objectives	After taking part successfully, students have reached the following lea	arning results			
Professional Competence					
Knowledge	The students are able to classify and describe signals and linear time	e-invariant (LTI) systems using metho	ods of signal and syste	em theory. They are	
	to apply the fundamental transformations of continuous-time and disc	rete-time signals and systems. They	can describe and analy	yse deterministic si	
	and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image domain which				
	caused by the transition of a continuous-time signal to a discrete-time signal.				
Skills	The students are able to describe and analyse deterministic signals and linear time-invariant systems using methods of signal and system theory. To				
	can analyse and design basic systems regarding important properties such as magnitude and phase response, stability, linearity etc They can ass				
	the impact of LTI systems on the signal properties in time and frequent	ıcy domain.			
Personal Competence					
Social Competence	The students can jointly solve specific problems.				
Autonomy	The students are able to acquire relevant information from appropria	ate literature sources. They can con-	trol their level of know	ledge during the le	
7.0.0.13ffy	period by solving tutorial problems, software tools, clicker system.				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56				
Credit points	6				
Examination	Written exam				
Examination duration and scale	90 min				
Assignment for the Following		ptrical Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisation Elec				
Curricula	General Engineering Science (German program): Specialisation Com				
	General Engineering Science (German program): Specialisation Proc General Engineering Science (German program): Specialisation Biop				
	General Engineering Science (German program): Specialisation Diop General Engineering Science (German program): Specialisation Civil		ampuleon/		
	General Engineering Science (German program): Specialisation Med		піршзогу		
	General Engineering Science (German program): Specialisation Bior				
	General Engineering Science (German program, 7 semester): Specia		oulsory		
	General Engineering Science (German program, 7 semester): Specia				
	General Engineering Science (German program, 7 semester): Specia				
	General Engineering Science (German program, 7 semester): Specia				
	General Engineering Science (German program, 7 semester): Specia	, , , , , , , , , , , , , , , , , , , ,			
	General Engineering Science (German program, 7 semester): Specia			mnulsory	
	General Engineering Science (German program, 7 semester): Specia				
	General Engineering Science (German program, 7 semester): Specia				
	General Engineering Science (German program, 7 semester): Special				
	Compulsory	eciansation Mechanical Engineering	g, rocus materiais iri	Lingineering Scie	
	General Engineering Science (German program, 7 semester): Specia	alication Mechanical Engineering Fo	cue Machatronice: Con	nnuleon/	
	General Engineering Science (German program, 7 semester): Spe Compulsory	Johannation Meditatioal Engineering	, rocus mediencal IV	noonamoar Enginer	
	Computer Science: Core qualification: Compulsory				
	Electrical Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation Civil-	- and Environmental Engangering: Co	mnulsory		
	General Engineering Science (English program): Specialisation Civil- General Engineering Science (English program): Specialisation Biop		привогу		
	General Engineering Science (English program): Specialisation Elect				
	General Engineering Science (English program): Specialisation Com	0 0 1 7			
	General Engineering Science (English program): Specialisation Com General Engineering Science (English program): Specialisation Med				
	General Engineering Science (English program): Specialisation Biom				
	General Engineering Science (English program): Specialisation Proc				
	General Engineering Science (English program, 7 semester): Special		nulsory		
	General Engineering Science (English program, 7 semester): Special		•		
	General Engineering Science (English program, 7 semester): Special				
	General Engineering Science (English program, 7 semester): Special				
	General Engineering Science (English program, 7 semester): Special				
	General Engineering Science (English program, 7 semester): Special			npulsorv	
	General Engineering Science (English program, 7 semester): Special				
	General Engineering Science (English program, 7 semester): Special		• •		
	General Engineering Science (English program, 7 semester): Special				
	Compulsory	os.a.ioanon wiconamical Engineering	g, 1 0000 materials III	Linginiosining Gold	
	General Engineering Science (English program, 7 semester): Special	lisation Mechanical Engineering For	rus Mechatronice: Com	nulsory	
	General Engineering Science (English program, 7 semester): Special General Engineering Science (English program, 7 semester): Special				
	Compulsory	oransation wednamed Engineering	, rocus medielical IV	ioonamoai Eligiilet	
	Computational Science and Engineering: Core qualification: Compuls	sony			



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	s
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle Content	
	Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)
	Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

Course L0433: Signals and Systems	s
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0596: Advanced	Mechanical Design Project	
Courses		
Title	Typ Hrs/wk CP	
Advanced Mechanical Design Project (L0)	Practical Course 4 6	
Module Responsible	Prof. Dieter Krause	
Admission Requirements	None	
Recommended Previous		
Knowledge	Mechanical Engineering: Design Advanced Machanical Engineering: Design	
	Advanced Mechanical Engineering Design	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge	After passing the module, students are able to:	
	the control of the co	
	express the procedure for systematically handling of complex design tasks.	
	 complex design tasks , describe working principles, their use and combination possibilities, 	
	explain guidelines for designing for function and manufacturing,	
	explain advanced use-oriented knowledge of machine elements.	
	onplant actualises are shorted themself of maximis distribute.	
Skills	After passing the module, students are able to:	
	analyze complex tasks and develop principle solutions using sketches,	
	convert principle solutions into a detailed design,	
	 use methods to design and solve engineering design tasks systematically and solution-oriented, 	
	 create a technical documentation including all necessary technical drawings to understand the functions of the system, 	
	document calculations of selected machine elements clearly and in detail.	
Personal Competence		
Social Competence	After passing the module, students are able to:	
	 present and discuss solutions and technical drawings within groups, 	
	reflect the own results in the work groups of the course	
Autonomy	After pecaling the module at idente are able to	
Autonomy	After passing the module, students are able to:	
	independently solve complex design projects, while motivating themselves, acquiring necessary knowledge and selecting appropriate methods.	hods
	to independently solve problems.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Credit points	6	
Examination	Written exam	
Examination duration and scale	180	
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulso	ory
	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory	у
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compu	ulso
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ	uctio
	Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engine	eeri
	Compulsory	
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory	
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsor	-
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory	-
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compu	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Development an	ucti
	Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engine	əeri
	Compulsory Make and Figure 2 and 15 feeting 2 and 15 fee	
	Mechanical Engineering: Core qualification: Compulsory	



Course L0266: Advanced Mechanic	al Design Project
Тур	Practical Course
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff, Dr. Jens Schmidt, Dr. Volkert Wollesen
Language	DE
Cycle	WiSe
Content	Das Konstruktionsprojekt gliedert sich in den Entwurf eines Getriebes sowie die Lösungsfindung.
	Getriebekonstruktion in Einzelarbeit
	Erarbeitung von Lösungsprinzipien
	Berechnung von Maschinenelementen
	Entwurf eines Getriebes im Hauptschnitt plus allen Außenansichten
	Erstellung einer ausführlichen Dokumentation
	Lösungsfindung
	 Methodische Erarbeitung von prinzipiellen Lösungskonzepten
	Erstellen einer Dokumentation
Literature	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Bücher zu speziellen Themen
<u> </u>	



Module M1320: Simulation	and Design of Mechatronic Systems			
Courses				
Title		Тур	Hrs/wk	CP
Simulation and Design of Mechatronic Sys		Lecture	2	2
Simulation and Design of Mechatronic Sys		Laboratory	1	2
Simulation and Design of Mechatronic Sys		Recitation Section (large)	1	2
Module Responsible				
Admission Requirements	None			
Recommended Previous	Fundatmentals of mechanics, control theory and electrical engineering	g		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following lea	arning results		
Professional Competence				
Knowledge	Students are able to describe methods and calculations for design, m	odeling, simulation and optimization	of mechatronic systen	ns.
21.11				
Skills	Students are able to apply modern algorithms for modeling of model	echatronic systems. They can identi	ty, simulate and des	ign simple systems and
	implement those in laboratory conditions.			
Personal Competence				
Social Competence	Students are able to work goal-oriented in small mixed groups and pr	esent results to target groups.		
Autonomy	Students are able to recognize and improve knowledge deficits indep	pendently.		
	With instructor assistance, students are able to evaluate their own known	owledge level and define a further cou	urse of study.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Med	hanical Engineering, Focus Mechatro	nics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Med	hanical Engineering, Focus Aircraft S	ystems Engineering:	Compulsory
	General Engineering Science (German program): Specialisation Med	hanical Engineering, Focus Theoretic	cal Mechanical Engine	eering: Compulsory
	General Engineering Science (German program, 7 semester): Specia	ulisation Mechanical Engineering, Foo	cus Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semester): Specia	llisation Mechanical Engineering, Foo	cus Aircraft Systems E	ngineering: Compulsory
	General Engineering Science (German program, 7 semester): Spe	ecialisation Mechanical Engineering	Focus Theoretical N	Mechanical Engineering:
	Elective Compulsory			
	General Engineering Science (English program): Specialisation Med	nanical Engineering, Focus Aircraft Sy	ystems Engineering: 0	Compulsory
	General Engineering Science (English program): Specialisation Med			, ,
	General Engineering Science (English program): Specialisation Med			ering: Compulsory
	General Engineering Science (English program, 7 semester): Specia		-	
	General Engineering Science (English program, 7 semester): Specia			
	General Engineering Science (English program, 7 semester): Spe		•	
	Elective Compulsory			
	Mechanical Engineering: Specialisation Aircraft Systems Engineering	g: Compulsory		
	Mechanical Engineering: Specialisation Mechatronics: Compulsory	,		
	Mechanical Engineering: Specialisation Theoretical Mechanical Engi	neering: Compulsory		
	Mechatronics: Core qualification: Compulsory	A 6		

Course L1822: Simulation and Design	gn of Mechatronic Systems
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Uwe Weltin
Language	DE
Cycle	WiSe
Content	Mechatronic Design
	Modeling
	Model Identifikation
	Numerical Methods in simulation
	Applications and examples in Matlab [®] and Simulink [®]
Literature	Skript zur Veranstaltung
	Weitere Literatur in der Veranstaltung



Course L1824: Simulation and Design	gn of Mechatronic Systems
Тур	Laboratory
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Uwe Weltin
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L1823: Simulation and Design	gn of Mechatronic Systems
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Uwe Weltin
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses	
Title	Typ Hrs/wk CP
Introduction to Control Systems (L0654) Introduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2
Module Responsible	
Admission Requirements	
Recommended Previous	
Knowledge	Traphotomator of orginal and options in time and noquoney domain, Eaphato Tantomin
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	
· ·	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second or
	systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus They can explain the Nyquist stability criterion and the stability margins derived from it.
	 They can explain the Nyquist stability criterion and the stability margins derived from it. They can explain the role of the phase margin in analysis and synthesis of control loops
	They can explain the role of the phase margin in analysis and synthesis of control loops They can explain the way a PID controller affects a control loop in terms of its frequency response
	They can explain the way a 1 to combine alreads a control top in terms of its frequency response They can explain issues arising when controllers designed in continuous time domain are implemented digitally
	They can explain locate along mentionic accigned in continued and accimplent and algularly
Skills	Students can transform models of linear dynamic systems from time to frequency domain and vice versa
	They can simulate and assess the behavior of systems and control loops
	They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules
	They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks
Personal Competence	
Social Competence	
Autonomy	
	problems.
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.
Workload in Hours	11. 1.0.1.7. 010.1.7. 11.1.7.
Credit points	6
Credit points Examination	6 Written exam
Credit points Examination Examination duration and scale	6 Written exam 120 min
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Credit points Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Fo
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engi
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsor
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: C
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energ
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Deprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Cletrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Meterials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechani
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory G
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering, Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program, 7 semester): Specialisa



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

Тур	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems
	Linear systems, differential equations and transfer functions The transfer systems of the system of the syst
	First and second order systems, poles and zeros, impulse and step response
	Stability
	Feedback systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Root locus techniques
	Root locus plots
	Root locus design of PID controllers
	Frequency response techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation
	Frequency response interpretation of PID control
	Time delay systems
	Root locus and frequency response of time delay systems
	Smith predictor
	Digital control
	Sampled-data systems, difference equations
	Tustin approximation, digital implementation of PID controllers
	Software tools
	Introduction to Matlab, Simulink, Control toolbox
	Computer-based exercises throughout the course
	- Computer success another and the contract
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010



Course L0655: Introduction to Contr	rol Systems
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses		
itle	Typ Hrs/wk	CP .
computer Engineering (L0321) computer Engineering (L0324)	Lecture 3 Recitation Section (small) 1	4 2
Module Responsible		
Admission Requirements		
Recommended Previous		
Knowledge		
	The successful completion of the labs will be honored during the evaluation of the module's examination according to the follow	ving rules:
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the succ	essful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.	
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge		vel programming down
	gates. The module includes the following topics:	, p = 3 = -
	• Introduction	
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks	
	Sequential logic: Flip-flops, automata, systematic hardware design Technological foundations	
	 Technological foundations Computer arithmetic: Integer addition, subtraction, multiplication and division 	
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining	
	Memories: Memory hierarchies, SRAM, DRAM, caches	
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the	
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a coll	
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing system	is - from gates and circi
	up to complete processors.	
	After successful completion of the module, the students are able to judge the interdependencies between a physical compute	er system and the softwa
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-cent	tric abstraction layers fr
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels h	have on an entire system
	performance and to propose feasible options.	
Personal Competence		
Personal Competence		
Personal Competence Social Competence		,
	Students are able to solve similar problems alone or in a group and to present the results accordingly.	,
Social Competence Autonomy	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.	
Social Competence Autonomy Workload in Hours	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56	
Social Competence Autonomy Workload in Hours Credit points	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56	
Social Competence Autonomy Workload in Hours Credit points Examination	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory	ory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	ory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory	ory ompulsory ompulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compuls General Enginee	ory ompulsory ompulsory Engineering: Compulso
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Miterials in General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials Compulsory	ory ompulsory iompulsory Engineering: Compulso in Engineering Science
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Cogeneral Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems (General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems (General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials Compulsory General Engineering Science (German p	ory ompulsory iompulsory Engineering: Compulso in Engineering Science
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Compuls	ory ompulsory compulsory Engineering: Compulso in Engineering Scienc Mechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems (General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials (Compulsory	ory ompulsory compulsory Engineering: Compulso in Engineering Scienc Mechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Miterials in Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Miterials in Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Miterials in Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Compulsory General Eng	ony compulsory compulsory Engineering: Compulso in Engineering Scienc Mechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 B Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems in General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems in General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems in General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems in General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems in Gener	ony compulsory compulsory Engineering: Compulso in Engineering Scienc Mechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Co General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Co General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Compuls	ony compulsory compulsory Engineering: Compulso in Engineering Scienc Mechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 8 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials of Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineeri	ony compulsory compulsory Engineering: Compulso in Engineering Scienc Mechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering; Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems I General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems I General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems I Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Devictory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Devictory General Engineering Science (German program, 7 semester): S	ony compulsory compulsory Engineering: Compulso in Engineering Scienc Mechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Students (Sempulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alteraft Systems (General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alteraft Systems (General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alteraft Systems (General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy S	ony compulsory compulsory Engineering: Compulso in Engineering Science Mechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Cc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: C General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanicals Engineering, Focus Biomechanics: C General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Arcraft Systems! General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engin	ony compulsory compulsory Engineering: Compulso in Engineering Science Mechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Students (Sempulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alteraft Systems (General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alteraft Systems (General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alteraft Systems (General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy S	ony compulsory compulsory Engineering: Compulso in Engineering Science Mechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program; Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science; Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Cc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems! General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems! General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Dev Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program, 7 semeste	ony compulsory compulsory Engineering: Compulso in Engineering Scienc Mechanical Engineeri

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Computational Science and Engineering: Core qualification: Compulsory
Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	ng
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	Introduction Combinational Logic Sequential Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005.

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0599: Integrated F	Product Development and Lightweight Design			
Courses				
Title CAE-Team Project (L0271) Development of Lightweight Design Produc	cts (L0270)	Typ Problem-based Learning Lecture	Hrs/wk 2 2	CP 2 2
Integrated Product Development I (L0269)		Lecture	2	2
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	Advanced Knowledge about engineering design:			
Knowledge	Fundamentals of Mechanical Engineering Design			
	Mechanical Engineering: Design			
	Advanced Mechanical Engineering Design			
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	After completing the module, students are capable of:			
	 explaining the functional principle of 3D-CAD-Systems, Pl describing the interaction of the different CAE-Systems in 	•		
Skills				
	After completing the module, students are able to:			
	 evaluate different CAD- and PDM-Systems with regards to design an exemplary product using CAD-,PDM- and/or FE 		ication schemes and	product structuring
Personal Competence Social Competence	After completing the module, students are able to: To develop a project plan and allocate work appropriate were present project results as a team for instance in a present		discussions	
Autonomy	Students are capable of:			
rationity				
	 independently adapt to a CAE-Tool and complete a given 	practical task with it		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90			
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Compulsory	Mechanical Engineering, Focus Product Decialisation Mechanical Engineering, Foc	Development and Prous Aircraft Systems E	duction: Compulsory
	General Engineering Science (English program): Specialisation of General Engineering Science (English program): Specialisation of General Engineering Science (English program, 7 semester): Specialise Engineering Science (English program, 7 semester): Specialise Compulsory Mechanical Engineering: Specialisation Product Development and	Mechanical Engineering, Focus Product D ecialisation Mechanical Engineering, Focu Specialisation Mechanical Engineering, I	evelopment and Proc us Aircraft Systems Er	duction: Compulsory
	Mechanical Engineering: Specialisation Aircraft Systems Enginee Product Development, Materials and Production: Technical Comp		Compulsory	



Course L0271: CAE-Team Project	
Тур	Problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause
Language	DE
Cycle	SoSe
Content	 Practical Introduction in the used software systems (Creo, Windchill, Hyperworks) Team formation, allocation of tasks and generation of a project plan Collective creation of one product out of CAD models supported by FEM calculations and PDM system Manufacturing of selected parts using 3D printer Presentation of results Description Part of the module is a project based team orientated practical course using the PBL method. In this course, students learn the handling of modern CAD, PDM and FEM systems (Creo, Windchill and Hyperworks). After a short introduction in the applied software systems, students work in teams on a task during the semester. The aim is the development of one product out of several CAD parts models using a PDM system including FEM calculations of selected parts and 3D printing of parts. The developed product must be presented in a joint presentation.
Literature	-

Course L0270: Development of Lightweight Design Products		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause	
Language	DE	
Cycle	SoSe	
Content	 Lightweight design materials Product development process for lightweight structures Dimensioning of lightweight structures 	
Literature	 Schürmann, H., "Konstruieren mit Faser-Kunststoff-Verbunden", Springer, Berlin, 2005. Klein, B., "Leichtbau-Konstruktion", Vieweg & Sohn, Braunschweig, 1989. Krause, D., "Leichtbau", In: Handbuch Konstruktion, Hrsg.: Rieg, F., Steinhilper, R., München, Carl Hanser Verlag, 2012. Schulte, K., Fiedler, B., "Structure and Properties of Composite Materials", Hamburg, TUHH - TuTech Innovation GmbH, 2005. Wiedemann, J., "Leichtbau Band 1: Elemente", Springer, Berlin, Heidelberg, 1986. 	

Course L0269: Integrated Product Development I		
Тур	Lecture	
Hrs/wk		
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause	
Language	DE	
Cycle	SoSe	
Content	Introduction to Integrated Product Development 3D CAD -Systems and CAD interfaces Administration of part lists / PDM systems PDM in different industries Selection of CAD-/PDM Systems Simulation Construction methods Design for X	
Literature	 Ehrlenspiel, K.: Integrierte Produktentwicklung, München, Carl Hanser Verlag Lee, K.: Principles of CAD / CAM / CAE Systems, Addison Wesles Schichtel, M.: Produktdatenmodellierung in der Praxis, München, Carl Hanser Verlag Anderl, R.: CAD Schnittstellen, München, Carl Hanser Verlag Spur, G., Krause, F.: Das virtuelle Produkt, München, Carl Hanser Verlag 	



Module M0767: Aeronautic	al Systems			
Courses				
Title		Тур	Hrs/wk	СР
Fundamentals of Aircraft Systems (L0741)		Lecture	2	2
Fundamentals of Aircraft Systems (L0742)		Recitation Section (small)	1	1
Air Transportation Systems (L0591)		Lecture	2	2
Air Transportation Systems (L0816)		Recitation Section (large)	1	1
Module Responsible	Prof. Frank Thielecke			
Admission Requirements	none			
Recommended Previous	Basics of mathematics, mechanics and thermodynamic	s		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge	Students get a basic understanding of the structure and	I design of an aircraft, as well as an overview of th	e systems inside an a	ircraft. In addition, a basic
Ü	knowledge of the relationchips, the key parameters, role	es and ways of working in different subsystems in	the air transport is acq	uired.
Skills	Due to the learned cross-system thinking students	can gain a deeper understanding of different	system concepts an	d their technical system
	implementation. In addition, they can apply the learne	d methods for the design and assessment of sul	osystems of the air tra	nsportation system in the
	context of the overall system.	-	•	,
Personal Competence				
Social Competence	Students are made aware of interdisciplinary communic	cation in groups.		
Autonomy	Students are able to independently analyze different sy	stem concepts and their technical implementation	as well as to think sys	tem oriented.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	150 min			
Assignment for the Following	General Engineering Science (German program): Spec	ialisation Mechanical Engineering, Focus Aircraft	Svstems Engineering:	Compulsory
Curricula	General Engineering Science (German program, 7 sem	* *		
3	General Engineering Science (English program): Speci	, ,	,	. ,
	General Engineering Science (English program, 7 sem			
	Logistics and Mobility: Specialisation Logistics and Mob		,	3 1
	Mechanical Engineering: Specialisation Aircraft System	·		

Course L0741: Fundamentals of Aircraft Systems		
Julise Lutet. Fullularite it all transfer and an aystems		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Frank Thielecke	
Language	DE	
Cycle	SoSe	
Content	- Development of aircrafts, fundamentals of flight physics, propulsion systems, analysis of ranges and loads, aircraft-structures and materials	
	- Hydraulic and electrical power systems, landing gear systems, flight-control and high-lift systems, air conditioning systems	
Literature	- Shevell, R. S.: Fundamentals of Flight	
	- TÜV Rheinland: Luftfahrtzeugtechnik in Theorie und Praxis	
	- Wild: Transport Category Aircraft Systems	

Course L0742: Fundamentals of Aircraft Systems	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Thielecke
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0591: Air Transportation Systems		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Volker Gollnick	
Language	DE	
Cycle	SoSe	
Content	1. Air transport as part of the global transportation system 2. Legal basis of air transportation 3. Safety and security aspects 4. Aircraft basics 5. The role of the aircraft amnufacturer 6. The role of the aircraft operator 7. Airport operation 8. The principles of air traffic management 9. Environmental aspects of air transportation 10. Future perspectives of air transport	
Literature	 V. Gollnick, D. Schmitt: "Air Transport System", Springer-Verlag, ISBN 978-3-7091-1879-5 H. Mensen: "Handbuch der Luftfahrt", Springer-Verlag, 2003 K. Hünecke: "Die Technik des modernen Verkehrsflugzeugs", Motorbuch-Verlag, 2000, ISBN 3-613-01895-0 I. Moir, A. Seabridge: "Aircraft Systems", AIAA Education Series, 2001, ISBN 1-56347-506-5 D.P. Raymer: "Aircraft Design - A Conceptual Approach", AIAA Education Series, 2006, ISBN 1-56347-281-3 N. Ashford: "Airport Operations", McGraw-Hill, 1997, ISBN 0-07-003077-4 P. Maurer: "Luftverkehrsmanagement", Oldenbourg-Verlag, ISBN 3-486-27422-8 H. Mensen: "Moderne Flugsicherung", Springer-Verlag, 2004, ISBN 3-540-20581-0 	

Course L0816: Air Transportation Systems	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Volker Gollnick
Language	DE
Cycle	SoSe
Content	Practical exercises to understand
	aircraft movement in wind conditions aircraft performance analyses radio navigation prinicples Objective: Understanding and application of principle methods to practical aviation problems
Literature	Hünnecke: Das moderne Verkehrsflugzeug von heute Flühr: Avionik und Flugsicherungstechnik



Courses	
Title	Typ Hrs/wk CP
Introduction to Management (L0880)	Lecture 3 3
Project Entrepreneurship (L0882)	Problem-based Learning 2 3
Module Responsible	
Admission Requirements	
Recommended Previous Knowledge	
Educational Objectives	
Professional Competence	
Knowledge	
Skills	 explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions from field of Management explain the most important aspects of and goals in Management and name the most important aspects of entreprneurial projects describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and hur ressource management, information management, innovation management and marketing explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives and uncertainty, and exp some basic methods from mathematical Finance state basics from accounting and costing and selected controlling methods. Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry out Entrepreneurship project in a team. In particular, they are able to analyse Management goals and structure them appropriately analyse organisational and staff structures of companies apply methods for decision making under multiple objectives, under uncertainty and under risk analyse production and procurement systems and Business information systems analyse and apply basic methods of marketing select and apply basic methods from mathematical finance to predefined problems apply basic methods from accounting, costing and controlling to predefined problems
Personal Competence Social Competence	
Autonomy	 Students are able to work in a team and to organize the team themselves to write a report on their project.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Examination	Written exam
Examination duration and scale	90 minutes
Assignment for the Following	
Curricula	
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Energy and Environmental Engineering: Compulsory
	General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering, Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering, Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

 $General\ Engineering\ Science\ (English\ program):\ Specialisation\ Bioprocess\ Engineering:\ Compulsory$

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program); Specialisation Process Engineering; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester); Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences
Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

 $\label{logistics} \textbf{Logistics and Mobility: Core qualification: Compulsory}$

 $\label{thm:mechanical engineering:Core qualification:Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolf
	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Manage Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.
	Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Course L0882: Project Entrepreneurship		
Тур	Problem-based Learning	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke	
Language	DE	
Cycle	WiSe/SoSe	
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,	
	using their knowledge from the corresponding lecture.	
	Project work is carried out in teams with the support of a mentor.	
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.	



Focus Materials in Engineering Sciences

In the specialization "materials in the engineering sciences" the graduates learn how to systematically and methodically analyze and understand fundamental materials-related phenomena. They have broad knowledge of the material science basics of structural and functional materials, including metals, polymers and ceramics. The graduates understand the impact of composition, processing, and service conditions on the material's behavior. Based on this understanding they can assess the suitability of materials for specific technological problems.

Module M0597: Advanced	Mechanical Engineering Design			
Courses				
Title		Typ	Hrs/wk	СР
	W (1 000 t)	Тур		
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Advanced Mechanical Engineering Design	I (L0262)	Lecture	2	2
Advanced Mechanical Engineering Design	I (L0263)	Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	a Francisco of Machanical Engineering Design			
Knowledge	Fundamentals of Mechanical Engineering Design			
	Mechanics			
	 Fundamentals of Materials Science 			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
•	3,,	3 3		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	 explain complex working principles and functions of m 	achine elements and of basic elements of fluid	dics,	
	 explain requirements, selection criteria, application sc 	enarios and practical examples of complex ma	chine elements,	
	 indicate the background of dimensioning calculations. 			
	and the same same same same same same same sam			
Skills	After passing the module, students are able to:			
	 accomplish dimensioning calculations of covered made 	chine elements,		
	 transfer knowledge learned in the module to new requ 			
	 recognize the content of technical drawings and scher 	natic sketches,		
	 evaluate complex designs, technically. 			
Personal Competence				
Social Competence				
•	 Students are able to discuss technical information in the 	ne lecture supported by activating methods.		
Autonomy	Students are able to independently deepen their acqu	ired knowledge in eversions		
	Students are able to acquire additional knowledge	and to recapitulate poorly understood conte	nt e.g. by using the	video recordings of th
	lectures.			
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Credit points	6			
	Weiter			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Specialisat	ion Mechanical Engineering, Focus Energy Sy	stems: Compulsory	
Curricula	General Engineering Science (German program): Specialisat			Compulson
Curricula		-		
	General Engineering Science (German program): Specialisat	ion Mechanical Engineering, Focus Materials	n ⊨ngineering Scier	ices: Compulsory
	General Engineering Science (German program): Specialisat	ion Mechanical Engineering, Focus Mechatror	nics: Compulsory	
	General Engineering Science (German program): Specialisat	ion Mechanical Engineering, Focus Product D	evelopment and Pro	duction: Compulsory
	General Engineering Science (German program): Specialisat			
	Sonora Engineering colones (German program). Specialisat	.oonamoar Engineering, roods medicitie		
	Canaral Engineering Calanta (Canara and Tanara Tana	Considiration Machanian Francisco F	o Airorett Comme	
	General Engineering Science (German program, 7 semester)	1 0 0	,	ngineering: Compulsor
	General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semes	1 0 0	,	ngineering: Compulsor
		1 0 0	,	ngineering: Compulsor
	General Engineering Science (German program, 7 semes Compulsory	ter): Specialisation Mechanical Engineering	Focus Materials in	ngineering: Compulsor Engineering Science
	General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semester)	ter): Specialisation Mechanical Engineering.	Focus Materials in	ngineering: Compulsor Engineering Science
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semester)	ter): Specialisation Mechanical Engineering.	Focus Materials in	ngineering: Compulsor Engineering Science
	General Engineering Science (German program, 7 semes Compulsory General Engineering Science (German program, 7 semester)	ter): Specialisation Mechanical Engineering.	Focus Materials in	ngineering: Compulsor Engineering Science
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semester)	ter): Specialisation Mechanical Engineering. : Specialisation Mechanical Engineering, Focuer): Specialisation Mechanical Engineering, Focuery:	Focus Materials in its Mechatronics: Corocus Product Deve	ngineering: Compulsor n Engineering Science mpulsory lopment and Production
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semester) Compulsory	ter): Specialisation Mechanical Engineering. : Specialisation Mechanical Engineering, Focuer): Specialisation Mechanical Engineering, Focuery:	Focus Materials in its Mechatronics: Corocus Product Deve	ngineering: Compulsor n Engineering Science mpulsory lopment and Productio
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semest Compulsory	ter): Specialisation Mechanical Engineering, : Specialisation Mechanical Engineering, Focusing: Specialisation Mechanical Engineering, Focusing: Specialisation Mechanical Engineering,	Focus Materials in s Mechatronics: Corocus Product Deversions Theoretical I	ngineering: Compulsor n Engineering Science mpulsory opment and Productio Mechanical Engineerin
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester)	ter): Specialisation Mechanical Engineering, : Specialisation Mechanical Engineering, Focusing: Specialisation Mechanical Engineering, Fer): Specialisation Mechanical Engineering, : Specialisation Mechanical Engineering, Focusing	Focus Materials in its Mechatronics: Corocus Product Deversion Theoretical Its Biomechanics: Corocus States in the instance of	ngineering: Compulsor n Engineering Science mpulsory opment and Production Mechanical Engineering
	General Engineering Science (German program, 7 semester)	ter): Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focusing:	Focus Materials in its Mechatronics: Corocus Product Deversion Theoretical Its Biomechanics: Corocus Energy Systems: (ngineering: Compulsor n Engineering Science mpulsory opment and Productio Mechanical Engineerin mpulsory
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester)	ter): Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focusing:	Focus Materials in its Mechatronics: Corocus Product Deversion Theoretical Its Biomechanics: Corocus Energy Systems: (ngineering: Compulsor n Engineering Science mpulsory opment and Productio Mechanical Engineerin mpulsory
	General Engineering Science (German program, 7 semester)	ter): Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focusing: Specialisation Mechanical Engineering, Foer): Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focusing Specialisation Mechanical Engineering, Focusing Specialisation Mechanical Engineering, Focus Energy Systems	Focus Materials in its Mechatronics: Corocus Product Deversion Theoretical Its Biomechanics: Corocus Energy Systems: (Stems: Compulsory)	ngineering: Compulsor n Engineering Science mpulsory lopment and Productio Mechanical Engineerin mpulsory Compulsory
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (English program): Specialisati General Engineering Science (English program): Specialisati	ter): Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focusing: Specialisation Mechanical Engineering, Focusing: Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focusing: Specialisation Mechanical Engineering, Focusing Mechanical Engineering, Focusing Specialisation Mechanical Engineering, Focus Energy Systom Mechanical Engineering, Focus Aircraft Systom Mechanical Engineering Mechanical Engineer	Focus Materials in its Mechatronics: Corocus Product Deve Focus Theoretical Its Biomechanics: Corocus Energy Systems: Compulsory stems: Compulsory stems Engineering: (ngineering: Compulsor n Engineering Science mpulsory lopment and Productio Mechanical Engineerin mpulsory Compulsory Compulsory
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (English program): Specialisati General Engineering Science (English program): Specialisati General Engineering Science (English program): Specialisati	ter): Specialisation Mechanical Engineering, : Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, : Specialisation Mechanical Engineering, Foct : Specialisation Mechanical Engineering, Foct on Mechanical Engineering, Focus Energy Sy on Mechanical Engineering, Focus Aircraft Sy on Mechanical Engineering, Focus Materials i	Focus Materials in Is Mechatronics: Confocus Product Development of Secus Theoretical Is Biomechanics: Constant Secus Energy Systems: Compulsory Stems: Compulsory Stems Engineering: Confocus Engineering: Confocus Engineering Scientific Secus Engineering Scientific Security Secus Engineering Scientific Security Secus Engineering Scientific Secus Engineering Secus Engineering Scientific Secus Engineering Engineering Secus Engineering Engi	ngineering: Compulsor n Engineering Science mpulsory lopment and Productio Mechanical Engineerin mpulsory Compulsory Compulsory
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (English program): Specialisati General Engineering Science (English program): Specialisati	ter): Specialisation Mechanical Engineering, : Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, : Specialisation Mechanical Engineering, Foct : Specialisation Mechanical Engineering, Foct on Mechanical Engineering, Focus Energy Sy on Mechanical Engineering, Focus Aircraft Sy on Mechanical Engineering, Focus Materials i	Focus Materials in Is Mechatronics: Confocus Product Development of Secus Theoretical Is Biomechanics: Constant Secus Energy Systems: Compulsory Stems: Compulsory Stems Engineering: Confocus Engineering: Confocus Engineering Scientific Secus Engineering Scientific Security Secus Engineering Scientific Security Secus Engineering Scientific Secus Engineering Secus Engineering Scientific Secus Engineering Engineering Secus Engineering Engi	ngineering: Compulsor n Engineering Science mpulsory lopment and Productio Mechanical Engineerin mpulsory Compulsory Compulsory
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (English program): Specialisati General Engineering Science (English program): Specialisati General Engineering Science (English program): Specialisati	ter): Specialisation Mechanical Engineering, : Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, Foct : Specialisation Mechanical Engineering, Foct : Specialisation Mechanical Engineering, Foct on Mechanical Engineering, Focus Energy Sy on Mechanical Engineering, Focus Aircraft Sy on Mechanical Engineering, Focus Materials i on Mechanical Engineering, Focus Mechanical in Mechanical Engineering, Focus Mechanical in Mechanical Engineering, Focus Mechanical	Focus Materials in Is Mechatronics: Confocus Product Development of Secus Theoretical Is Biomechanics: Constant Secus Energy Systems: Compulsory Stems Engineering: Confocus Engineering Scienics: Compulsory	ngineering: Compulsor n Engineering Science mpulsory opment and Productio Mechanical Engineerin mpulsory Compulsory Compulsory ces: Compulsory
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (English program): Specialisati	ter): Specialisation Mechanical Engineering, : Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, Foct : Specialisation Mechanical Engineering, Foct : Specialisation Mechanical Engineering, Foct on Mechanical Engineering, Focus Energy Sy on Mechanical Engineering, Focus Aircraft Sy on Mechanical Engineering, Focus Materials i on Mechanical Engineering, Focus Mechanical on Mechanical Engineering, Focus Mechanical on Mechanical Engineering, Focus Product De	Focus Materials in Is Mechatronics: Corocus Product Development and Procus Theoretical Is Biomechanics: Corocus Energy Systems: Compulsory Stems Engineering: Con Engineering Scienics: Compulsory evelopment and Procus Procus Engineering Scienics: Compulsory evelopment and Procus Pro	ngineering: Compulsor n Engineering Science mpulsory opment and Productio Mechanical Engineerin mpulsory Compulsory Compulsory ces: Compulsory duction: Compulsory
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (English program): Specialisati	ter): Specialisation Mechanical Engineering, : Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, Foct : Specialisation Mechanical Engineering, Foct : Specialisation Mechanical Engineering, Foct on Mechanical Engineering, Focus Energy Sy on Mechanical Engineering, Focus Aircraft Sy on Mechanical Engineering, Focus Materials i on Mechanical Engineering, Focus Mechanical on Mechanical Engineering, Focus Product Do on Mechanical Engineering, Focus Theoretical	Focus Materials in Is Mechatronics: Confocus Product Development and Product Development D	ngineering: Compulsor n Engineering Science mpulsory opment and Production Mechanical Engineering mpulsory Compulsory Compulsory ces: Compulsory duction: Compulsory tering: Compulsory
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (English program): Specialisati	ter): Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Foct Pri: Specialisation Mechanical Engineering, Foct Specialisation Mechanical Engineering, Foct Specialisation Mechanical Engineering, Foct Specialisation Mechanical Engineering, Foct Mechanical Engineering, Focus Energy Sy On Mechanical Engineering, Focus Materials i On Mechanical Engineering, Focus Mechatron On Mechanical Engineering, Focus Product De On Mechanical Engineering, Focus Theoretica Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus	Focus Materials in Is Mechatronics: Confocus Product Development and Product Development Sciences Sciences Aircraft Systems Engineering Sciences Sciences Sciences Development and Product Development and Product Development Sciences Sciences Sciences Development Development Sciences Development	ngineering: Compulsory In Engineering Science Impulsory
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (English program): Specialisati	ter): Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Foct Pri: Specialisation Mechanical Engineering, Foct Specialisation Mechanical Engineering, Foct Specialisation Mechanical Engineering, Foct Specialisation Mechanical Engineering, Foct Mechanical Engineering, Focus Energy Sy On Mechanical Engineering, Focus Materials i On Mechanical Engineering, Focus Mechatron On Mechanical Engineering, Focus Product De On Mechanical Engineering, Focus Theoretica Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus	Focus Materials in Is Mechatronics: Confocus Product Development and Product Development Sciences Sciences Aircraft Systems Engineering Sciences Sciences Development and Product Development and Product Development and Product Development and Product Development Sciences Sciences Development De	ngineering: Compulsor n Engineering Science mpulsory opment and Productio Mechanical Engineerin mpulsory Compulsory Compulsory duction: Compulsory duction: Compulsory reining: Compulsory
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (English program): Specialisati	ter): Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Foct Pri: Specialisation Mechanical Engineering, Foct Specialisation Mechanical Engineering, Foct Specialisation Mechanical Engineering, Foct Specialisation Mechanical Engineering, Foct Mechanical Engineering, Focus Energy Sy On Mechanical Engineering, Focus Materials i On Mechanical Engineering, Focus Mechatron On Mechanical Engineering, Focus Product De On Mechanical Engineering, Focus Theoretica Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus	Focus Materials in Is Mechatronics: Confocus Product Development and Product Development Sciences Sciences Aircraft Systems Engineering Sciences Sciences Development and Product Development and Product Development and Product Development and Product Development Sciences Sciences Development De	ngineering: Compulsor n Engineering Science mpulsory opment and Productio Mechanical Engineerin mpulsory Compulsory Compulsory duction: Compulsory duction: Compulsory reining: Compulsory
	General Engineering Science (German program, 7 semest Compulsory General Engineering Science (German program, 7 semester) General Engineering Science (English program): Specialisati General Engineering Science (English program, 7 semester): General Engineering Science (English program, 7 semester): General Engineering Science (English program, 7 semester):	ter): Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, Foct er): Specialisation Mechanical Engineering, Foct : Specialisation Mechanical Engineering, Foct : Specialisation Mechanical Engineering, Foct on Mechanical Engineering, Focus Energy Sy on Mechanical Engineering, Focus Aircraft Sy on Mechanical Engineering, Focus Materials i on Mechanical Engineering, Focus Mechatron on Mechanical Engineering, Focus Product De on Mechanical Engineering, Focus Theoretica Specialisation Mechanical Engineering, Focus ter): Specialisation Mechanical Engineering,	Focus Materials in security in the security is security in the	ngineering: Compulsor n Engineering Science mpulsory opment and Productio Mechanical Engineerin mpulsory Compulsory ces: Compulsory duction: Compulsory duction: Compulsory ngineering: Compulsory ngineering: Compulsory
	General Engineering Science (German program, 7 semester) General Engineering Science (English program): Specialisati General Engineering Science (English program, 7 semester): General Engineering Science (English program, 7 semester): General Engineering Science (English program, 7 semester):	ter): Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, Focter): Specialisation Mechanical Engineering, Focter): Specialisation Mechanical Engineering, Foction Me	Focus Materials in as Mechatronics: Confocus Product Development and Procus Theoretical II as Biomechanics: Confocus Energy Systems: Compulsory Stems Engineering: Confocus Compulsory evelopment and Procus II Mechanical Engines a Aircraft Systems Enfocus Materials in as Mechatronics: Com	ngineering: Compulsorn n Engineering Science mpulsory opment and Production Mechanical Engineering mpulsory Compulsory Compulsory duction: Compulsory duction: Compulsory ngineering: Compulsory ngineering: Compulsory ngineering: Compulsory ngineering: Science

Naval Architecture: Core qualification: Compulsory



Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Mechanical Engineering: Core qualification: Compulsory

rse L0264: Advanced Mechanical Engineering Design II		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	SoSe	
Content	Advanced Mechanical Engineering Design I & II	
	Lecture	
	Endoughly (No. 61) - Complete all and the complete	
	Fundamentals of the following machine elements: A linear reliable positions	
	Linear rolling bearings	
	Axes & shafts	
	• Seals	
	Clutches & brakes	
	Belt & chain drives	
	Gear drives	
	Epicyclic gears	
	Crank drives	
	Sliding bearings	
	Elements of fluidics	
	Exercise	
	Calculation methods of the following machine elements:	
	Linear rolling bearings	
	Axes & shafts	
	Clutches & brakes	
	Belt & chain drives	
	Gear drives	
	Epicyclic gears	
	• Crank gears	
	Sliding bearings	
	Calculations of hydrostatic systems (fluidics)	
Literature	a Dubbel Tasabanhuah fiir dan Masabinanhau Crata K. H. Faldhuann 1/Hrag \ Caringar Vadag altitulla Auflana	
	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Maschingsplangste Board I We Nicrosop C. Carinera Medica aldustla Auflage.	
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.	
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.	
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.	

Course L0265: Advanced Mechanic	Course L0265: Advanced Mechanical Engineering Design II	
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
 Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.

Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
 Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.

Sowie weitere Bücher zu speziellen Themen



Course L0262: Advanced Mechanic	al Engineering Design I	
	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
	DE	
Language		
Cycle	WiSe	
Content	Advanced Mechanical Engineering Design I & II	
	Lecture	
	Fundamentals of the following machine elements:	
	Linear rolling bearings Aura 8 a bath	
	Axes & shafts	
	Seals	
	Clutches & brakes	
	Belt & chain drives	
	Gear drives	
	Epicyclic gears	
	Crank drives Sliding bearings	
	Elements of fluidics	
	Exercise	
	Calculation methods of the following machine elements:	
	 Linear rolling bearings 	
	Axes & shafts	
	Clutches & brakes	
	Belt & chain drives	
	Gear drives	
	Epicyclic gears	
	Crank gears	
	Sliding bearings Calculations of hydrostatic systems (fluidics)	
	- Outstations of Hydrodiatio Systems (Indianos)	
Literature	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.	
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage. Maschinene und Kenthuldingslemente Chickilles W. Piene B. Gringer Verlag, aktuelle Auflage.	
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Til Chen vir it in DNN seed (frie M. Technology) (des	
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. Kanthali and Bakhan Bak	
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.	
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.	
	 Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. 	
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.	
	Sowie weitere Bücher zu speziellen Themen	
	Sowie weitere bucher zu speziellen meinen	

Course L0263: Advanced Mechanical Engineering Design I	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



courses				
itle		Тур	Hrs/wk	CP
ignals and Systems (L0432)		Lecture	3	4
ignals and Systems (L0433)	Draf Carbard Rough	Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch None			
Admission Requirements Recommended Previous	Mathematics 1-3			
Knowledge	Mathematics 1-5			
	The modul is an introduction to the theory of signals and systems Further experience with spectral transformations (Fourier series, Fo	-	•	nematik 1-3 is expec
Educational Objectives	After taking part successfully, students have reached the following le	earning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and linear tin	me-invariant (LTI) systems using metho	ds of signal and syste	em theory. They are a
	to apply the fundamental transformations of continuous-time and dis	screte-time signals and systems. They o	an describe and anal	yse deterministic sig
	and systems mathematically in both time and image domain. In p		n time domain and i	mage domain which
	caused by the transition of a continuous-time signal to a discrete-time	ne signal.		
Skills	The students are able to describe and analyse deterministic signal			
	can analyse and design basic systems regarding important proper		oonse, stability, linear	ity etc They can ass
	the impact of LTI systems on the signal properties in time and freque	ency domain.		
Personal Competence	The shortests are later to the			
Social Competence	The students can jointly solve specific problems.	7-1- P1	and the start of the start	tadas a respect
Autonomy	The students are able to acquire relevant information from approp	riate literature sources. They can cont	roi their level of know	reage during the lea
Westerday	period by solving tutorial problems, software tools, clicker system.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points				
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Ele			
Curricula	General Engineering Science (German program): Specialisation Co			
	General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Bio			
	General Engineering Science (German program): Specialisation Ci-		mnulsory	
	General Engineering Science (German program): Specialisation Me		paicery	
	General Engineering Science (German program): Specialisation Bio			
	General Engineering Science (German program, 7 semester): Spec		ulsory	
	General Engineering Science (German program, 7 semester): Spec	ialisation Computer Science: Compuls	ory	
	General Engineering Science (German program, 7 semester): Spec	ialisation Process Engineering: Compu	lsory	
	General Engineering Science (German program, 7 semester): Spec	ialisation Bioprocess Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester): Spec	ialisation Biomedical Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester): Spec	ialisation Mechanical Engineering, Foo	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Spec			
	General Engineering Science (German program, 7 semester): Spec			
	General Engineering Science (German program, 7 semester): S Compulsory			
	General Engineering Science (German program, 7 semester): Spec			
	General Engineering Science (German program, 7 semester): Space (Compulsory Computer Science: Core qualification: Compulsory	pecialisation Mechanical Engineering.	Focus Theoretical N	Mechanical Engineer
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Civ	ril- and Enviromental Engeneering: Cor	npulsory	
	General Engineering Science (English program): Specialisation Bio			
	General Engineering Science (English program): Specialisation Ele			
	General Engineering Science (English program): Specialisation Co			
	General Engineering Science (English program): Specialisation Me	chanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Bio	medical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Program	ocess Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Speci			
	General Engineering Science (English program, 7 semester): Speci			
	General Engineering Science (English program, 7 semester): Speci		-	
	General Engineering Science (English program, 7 semester): Speci			
	General Engineering Science (English program, 7 semester): Speci			mpulsor:
	General Engineering Science (English program, 7 semester): Speci			
	General Engineering Science (English program, 7 semester): Speci General Engineering Science (English program, 7 semester): Speci			
	General Engineering Science (English program, 7 semester): S			
	Congress Engineering Science (English program 7 competer): Speci	alication Machanian Francisco	io Moobettee	nulcon:
	General Engineering Science (English program, 7 semester): Speci			
	General Engineering Science (English program, 7 semester): Speci General Engineering Science (English program, 7 semester): Sp			
	General Engineering Science (English program, 7 semester): Speci	pecialisation Mechanical Engineering,		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	s
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle Content	Basic classification and description of continuous-time and discrete-time signals and systems
	Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)
	Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

Course L0433: Signals and Systems	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0988: Structural N	Materials			
modulo modo. otractarari	indo indo			
Courses				
Title		Тур	Hrs/wk	СР
Fundamentals of Mechanical Properties of	Materials (L1090)	Lecture	2	3
Welding Technology (L1123)		Lecture	3	3
Module Responsible	Prof. Claus Emmelmann			
Admission Requirements	None			
Recommended Previous	Fundamentals of Materials Science			
Knowledge				
Educational Objectives	After taking part successfully, students have reached	d the following learning results		
Professional Competence				
Knowledge	The students get to know the principles that are res	sponsible for the mechanical behaviour of metals.	They acquire basic knowl	egde in modelling of the
	materials behaviour. Furthermore, the students lear	rn about the behaviour of metals under static and	dynamic loads. The stude	nts get to know the most
	important welding technologies and the correspond	ing systems. They learn about the influence of wel-	ding on the materials and	design.
Skills	The students know the mechanical properties of metals and the underlying principles. They are able to name the influencing factors on the welding			n factors on the welding
Okino	behaviour of steel materials.			
	The students are able to select between alloys according to the desired mechaincal properties and welability. They can distinguish between different			
	welding techniques and select the suitable technique and system components for a defined application. They are able to dimension weld joints within			
	design tasks.			
Personal Competence				
Social Competence	none			
Autonomy	none			
Workload in Hours	Independent Study Time 110, Study Time in Lecture	70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory			
Curricula	General Engineering Science (German program,	7 semester): Specialisation Mechanical Engine	ering, Focus Materials in	Engineering Sciences:
	Compulsory			
	General Engineering Science (English program): Sp	pecialisation Mechanical Engineering, Focus Mate	rials in Engineering Scien	ces: Compulsory
	General Engineering Science (English program,	7 semester): Specialisation Mechanical Engine	ering, Focus Materials in	Engineering Sciences:
	Compulsory			
	Mechanical Engineering: Specialisation Materials in	n Engineering Sciences: Compulsory		

Course L1090: Fundamentals of Mechanical Properties of Materials		
	· · · · · · · · · · · · · · · · · · ·	
	Lecture	
Hrs/wk		
СР		
	Independent Study Time 62, Study Time in Lecture 28	
	Prof. Norbert Huber, Dr. Erica Lilleodden	
Language		
Cycle	SoSe	
Content	1. Introduction and overview	
	2. Bonding and crystallography, stress, strain, linear elasticity	
	3. Plasticity of metallic materials	
	4. Dislocations: Structure, stress, strain, strain energy	
	5. Dislocations: Motion and forces	
	6. Partial dislocations, dislocation interactions, jogs and kinks	
	7. Strengthening mechanisms	
	8. Introduction to modelling of materials behaviour, classification of	
	phenomena	
	9. Linear and nonlinear elasticity	
	10. Plasticity, tensile loading, cyclic loading	
	11. Viscoelasticity, effects of loading history, creep, relaxation	
	12. Viscoplasticity, overstress, rate sensitivity of metallic materials	
	13. Identification of material parameters	
Literature	Hull and Bacon: Introduction to Dislocations (1984)	
	G. Gottstein: Physik. Grundlagen der Materialk. (2001)	
	N.Huber: Scriptum "Materialtheorie" Uni Karlsruhe (1998)	
	P. Haupt: Cont. Mechanics and Theory of Materials (2002)	



Course L1123: Welding Technology	
Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Claus Emmelmann, Prof. Karl-Ulrich Kainer
Language	DE
Cycle	WiSe
Content	- phase transitions, phase diagrams and thermal activated processes
	- fundamentals of steels, heat treatment applications for steels and time temperature transformation diagrams
	- properties of weldable carbon and fine grained steels
	- properties of weldable low- and high-alloy steels, corrosion resistant steels and high-strength steels
	- structure and properties of non-ferrite metals (aluminum, titanium)
	- NDT/DT Methods for materials and welds
	- gas fusion welding, fundamentals of electric arc welding technologies
	- structure and influence parameters for the welded joint
	- submerged arc welding/tungsten inert gas welding/inert gas metal arc welding (MIG)/active gas metal arc welding (MAG)/Plasma Welding
	- resistance welding/ polymer welding/ hybrid-welding
	- deposition welding
	- electron beam welding/ laser beam welding
	- weld joint designs and declarations
	- computation methods for weld joint dimensioning
Literature	Schulze, G.: Die Metallurgie des Schweißens, 4. Aufl., Berlin 2010 Strassburg, F.W. und Wehner H.: Schweißen nichtrostender Stähle, 4. Aufl.
	Düsseldorf, 2009 Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 1: Schweiß- und Schneidtechnologien, 3. Aufl., Berlin 2006.
	Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 2: Verhalten der Werkstoffe beim Schweißen, 3. Aufl., Berlin 2005.
	Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 3: Gestaltung und Festigkeit von Schweißkonstruktionen, 2. Aufl., Berlin 2002.



Courses				
Fitle Fitle		Тур	Hrs/wk	СР
Numerical Mathematics I (L0417)		Lecture	2	3
Numerical Mathematics I (L0418)		Recitation Section (small)	2	3
Module Responsible	Prof. Sabine Le Borne			
Admission Requirements	None			
Recommended Previous				
Knowledge	 Mathematik I + II for Engineering Students (german or engl 	sh) or Analysis & Linear Algebra I + II for	Technomathematicia	ans
	basic MATLAB knowledge			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence	γ,	3		
Knowledge	Students are able to			
Mibwieuge	olddenis are able to			
	 name numerical methods for interpolation, integration, le 	ast squares problems, eigenvalue prob	lems, nonlinear root	finding problems and
	explain their core ideas,			
	 repeat convergence statements for the numerical methods 			
	 explain aspects for the practical execution of numerical me 	thods with respect to computational and	storage complexitx.	
Skills	Students are able to			
	- Annales and a section of a se	AATI AD		
	implement, apply and compare numerical methods using N			
	justify the convergence behaviour of numerical methods w		gorithm,	
	 select and execute a suitable solution approach for a giver 	problem.		
Personal Competence				
Social Competence	Students are able to			
	 work together in heterogeneously composed teams (i.e., 			dge), explain theoretic
	foundations and support each other with practical aspects	regarding the implementation of algorithm	ns.	
Autonomy	Students are capable			
	to assess whether the supporting theoretical and practical	excercises are better solved individually	or in a team,	
	 to assess their individual progess and, if necessary, to ask 	questions and seek help.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation (
Curricula	General Engineering Science (German program): Specialisation M			
	General Engineering Science (German program): Specialisation M		in Engineering Scien	ices: Compulsory
	General Engineering Science (German program): Specialisation E			
	General Engineering Science (German program, 7 semester): Spe	·	•	Foots and a Octoor
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering	, Focus Materials in	Engineering Science
	Compulsory			
	General Engineering Science (German program, 7 semester): Spe			and the same
	General Engineering Science (German program, 7 semester): Spe		us Biomechanics: Co	mpulsory
	Bioprocess Engineering: Specialisation A - General Bioprocess E			
	Computer Science: Specialisation Computational Mathematics: El	ective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory	0		
	General Engineering Science (English program): Specialisation C			
	General Engineering Science (English program): Specialisation B			
	General Engineering Science (English program): Specialisation N			0
	General Engineering Science (English program): Specialisation N			ces: Compulsory
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering	, Focus Materials in	Engineering Science
	Compulsory			
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe		us Biomechanics: Cor	mpulsory
	Computational Science and Engineering: Core qualification: Com	·		
	Process Engineering: Specialisation Process Engineering: Elective	- Campanda and		



Course L0417: Numerical Mathema	tics I
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Sabine Le Borne, Dr. Patricio Farrell
Language	DE/EN
Cycle	WiSe
Content	 Error analysis: Number representation, error types, conditioning and stability Interpolation: polynomial and spline interpolation Numerical integration and differentiation: order, Newton-Cotes formula, error estimates, Gaussian quadrature, adaptive quadrature, difference formulas Linear systems: LU and Cholesky factorization, matrix norms, conditioning Linear least squares problems: normal equations, Gram.Schmidt and Householder orthogonalization, singular value decomposition, regularization Eigenvalue problems: power iteration, inverse iteration, QR algorithm Nonlinear systems of equations: Fixed point iteration, root-finding algorithms for real-valued functions, Newton and Quasi-Newton methods for systems
Literature	Stoer/Bulirsch: Numerische Mathematik 1, Springer Dahmen, Reusken: Numerik für Ingenieure und Naturwissenschaftler, Springer

Course L0418: Numerical Mathema	ourse L0418: Numerical Mathematics I		
Тур	Recitation Section (small)		
Hrs/wk	2		
CP	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Sabine Le Borne, Dr. Patricio Farrell		
Language	DE/EN		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		



Module M1009: Material Sci	iones Laboratory			
Wodule W1009: Waterial Sci	erice Laboratory			
Courses				
Title		Тур	Hrs/wk	СР
Companion Lecture for Materials Science	Laboratory (L1088)	Lecture	2	2
Material Science Laboratory (L1235)		Laboratory Course	4	4
Module Responsible	Prof. Bodo Fiedler			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learn	ning results		
Professional Competence				
Knowledge	Students are able to give a summary of the technical details of experim	nents in the area of materials science	ces and illustrate respe	ctive relationships. They
	are capable of describing and communicating relevant problems and	d questions using appropriate tec	hnical language. They	can explain the typical
	process of solving practical problems and present related results.			
Skille	The students can transfer their fundamental knowledge on material so	cionage to the process of solving p	ractical problems. The	v identify and aversame
Skills	typical problems during the realization of experiments in the context of		ractical problems. The	y identity and overcome
	typical problems during the realization of experiments in the context of	material sciences.		
Personal Competence				
Social Competence	Students are able to cooperate in small groups in order to conduct experiments in the context of materials sciences. They are able to effectively present			
	and explain their results alone or in groups in front of a qualified audier	nce.		
Autonomy	Students are capable of solving problems in the context of materials	sciences using provided literature	They are able to fill of	ans in as well as extent
rialonomy	their knowledge using the literature and other sources provided by the		. They are able to mi g	apo in do wen do extent
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Colloquium			
Examination duration and scale	1,5 h written Exam (50%) covering the lesson			
Assignment for the Following	General Engineering Science (German program): Specialisation Mech	anical Engineering Focus Material	s in Engineering Scien	ces: Compulsory
Curricula	General Engineering Science (German program): Specialisation Mech			
Garriodia	General Engineering Science (German program, 7 semester): Spe			
	Compulsory	olanoation Meditamoar Engineerin	ig, roods Materials III	Engineering colonics.
	General Engineering Science (English program): Specialisation Mecha	anical Engineering Focus Materials	s in Engineering Science	es: Compulsory
	General Engineering Science (English program): Specialisation Mecha			
	General Engineering Science (English program, 7 semester): Spec		·	
	Compulsory		J,	3g 25.5110001
	Mechanical Engineering: Specialisation Product Development and Pro	oduction: Compulsory		
	Mechanical Engineering: Specialisation Materials in Engineering Scientific Sc			
	Product Development, Materials and Production: Technical Compleme		e Compulsory	
	, - ,	•	1	

Course L1088: Companion Lecture	for Materials Colones Laboratory
•	·
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Patrick Huber
Language	DE
Cycle	WiSe
Content	Physico-chemical backgrounds and fundamental experimental principles with regard to the following experiments, the topics to be addressed are
	indicated in brackets for each experiment:
	1. Phase diagrams, heat treatment, hardness measurements (thermodynamics, elastic properties of solids)
	2. notch impact test (elastic properties of solids)
	3. Processes during the solidifaction of metals (thermodynamics and kinetics of solid-liquid phase transitions)
	4. tensile test (elastic properties of solids)
	5. Identificiation of polymers (polymer physics)
	6. fiber-reinforced polymers (physical principles of composite materials)
	7. Production and microstructure of ceramic materials (physico-chemical principles of ceramics)
	8. Mechanical properties of ceramic materials (elastic properties of solids and composite materials)
Literature	William D. Callister und David G. Rethwisch, Materialwissenschaften und Werkstofftechnik, Wiley&Sons, Asia (2011)
	William D. Callister, Materials Science and Technology, Wiley& Sons, Inc. (2007)



Course L1235: Material Science Laboratory		
Тур	Laboratory Course	
Hrs/wk	4	
CP	4	
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56	
Lecturer	Prof. Bodo Fiedler, Prof. Stefan Müller, Prof. Patrick Huber, Prof. Gerold Schneider, Prof. Jörg Weißmüller	
Language	DE	
Cycle	WiSe	
Content	8 Versuche:	
	Zustandsdiagramm, Wärmebehandlung, Härtemessung	
	Kerbschlagbiegeversuch	
	Vorgänge bei der Erstarrung von Metallen	
	Zugversuch	
	Identifizierung von Kunststoffen	
	Faserverstärkte Kunststoffe	
	Herstellung und Gefüge keramischer Werkstoffe	
	Mechanisches Verhalten keramischer Werkstoffe	
Literature	Vorlesungsunterlagen Grundlagen der Werkstoffwissenschaft I & II	



courses	
itle	Typ Hrs/wk CP
stroduction to Control Systems (L0654) stroduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2
Module Responsible	
Admission Requirements	none
Recommended Previous	Representation of signals and systems in time and frequency domain, Laplace transform
Knowledge	Trepresentation of signals and systems in time and nequency domain, Eaplace transform
Momeage	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	This lating part adocession, addents have reached the following realing results
Knowledge	
	 Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second o
	systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.
	They can explain the role of the phase margin in analysis and synthesis of control loops The control l
	 They can explain the way a PID controller affects a control loop in terms of its frequency response They can explain issues arising when controllers designed in continuous time domain are implemented digitally
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally
Skills	
	Students can transform models of linear dynamic systems from time to frequency domain and vice versa The control of the
	They can simulate and assess the behavior of systems and control loops They can design PID controllers with the hole of he write to (7 and a Nichola) trained rule.
	 They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks
	They can use standard software tools (waitab outline) rootbox, offiniting for earlying out these tasks
Personal Competence	
Social Competence	Students can work in small groups to jointly solve technical problems, and experimentally validate their controller designs
Autonomy	Students can obtain information from provided sources (lecture notes, software documentation, experiment guides) and use it when solving gi
	problems.
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.
	They can assess their knowledge in weekly off-line tests and thereby control their learning progress.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Workload in Hours Credit points	
	6
Credit points	6 Written exam
Credit points Examination	6 Written exam 120 min
Credit points Examination Examination duration and scale	6 Written exam 120 min
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviroremental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productompulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Eloridal Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineeria Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineeria Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semest
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ene
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Meteralis in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Ompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineer
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micrat Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environment
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micrat Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environment
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Rivil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Dioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering,
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Deprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (Engilsh program, 7 semester): Specialisation Compulsory General Engineering



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

e L0654: Introduction to Contr	ol Systems
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems
	Linear systems, differential equations and transfer functions
	First and second order systems, poles and zeros, impulse and step response
	Stability
	Feedback systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Root locus techniques
	Root locus plots
	Root locus design of PID controllers
	Frequency response techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation
	Frequency response interpretation of PID control
	Time delay systems
	Root locus and frequency response of time delay systems
	Smith predictor
	Digital control
	Sampled-data systems, difference equations
	Tustin approximation, digital implementation of PID controllers
	Software tools
	Introduction to Matlab, Simulink, Control toolbox
	Computer-based exercises throughout the course
	Company according to the control of
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010



Course L0655: Introduction to Control Systems		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Herbert Werner	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Courses				
Γitle	Ту		Hrs/wk	CP
Computer Engineering (L0321) Computer Engineering (L0324)		cture ecitation Section (small)	3 1	4
Module Responsible	Prof. Heiko Falk	onation coolion (ornati)		_
Admission Requirements	None			
Recommended Previous	Basic knowledge in electrical engineering			
Knowledge				
	The successful completion of the labs will be honored during the evaluation of t	the module's examination ac	ccording to the followi	ng rules:
	Upon a passed module examination, the student is granted a bonus	s on the examination's ma	rks due to the succe	ssful labs, such that t
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-	better grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not po	ossible.		
Educational Objectives	After taking part successfully, students have reached the following learning resu	ults		
Professional Competence	The along part accessors, state in a reading to the coloring realing real			
Knowledge	This module deals with the foundations of the functionality of computing syst	tems. It covers the lavers from	om the assembly-leve	el programming down
	gates. The module includes the following topics:			p. eg. ag
	Introduction			
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardw	rare synthesis, combination	al networks	
	Sequential logic: Flip-flops, automata, systematic hardware design Technological foundations			
	Computer arithmetic: Integer addition, subtraction, multiplication and div	vision		
	Basics of computer architecture: Programming models, MIPS single-cyc			
	Memories: Memory hierarchies, SRAM, DRAM, caches			
	 Input/output: I/O from the perspective of the CPU, principles of passing d 	data, point-to-point connection	ons, busses	
Skills	The students perceive computer systems from the architect's perspective, i.			
	computer systems. The students can analyze, how highly specific and indiv			
	components. They are able to distinguish between and to explain the different up to complete processors.	, abstraction layers of today	s computing systems	- Irom gales and circl
	up to complete processors.			
	After successful completion of the module, the students are able to judge the in	nterdependencies between	a physical computer	system and the softwa
	executed on it. In particular, they shall understand the consequences that the	execution of software has or	n the hardware-centri	c abstraction layers fr
	the assembly language down to gates. This way, they will be enabled to evaluate	ate the impact that these low	v abstraction levels ha	ve on an entire system
	performance and to propose feasible options.			
Personal Competence				
Social Competence	Students are able to solve similar problems alone or in a group and to present t	the results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific literature and to asso	ociate this knowledge with o	ther classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes, contents of course and labs			
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulso	ory		
Curricula	General Engineering Science (German program, 7 semester): Specialisation C	omputer Science: Compulso	ory	
	General Engineering Science (German program, 7 semester): Specialisation Bi	ioprocess Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semester): Specialisation N	aval Architecture: Compulso	ory	
	General Engineering Science (German program, 7 semester): Specialisation C		•	
	General Engineering Science (German program, 7 semester): Specialisation El			
	General Engineering Science (German program, 7 semester): Specialisation Bi			
	General Engineering Science (German program, 7 semester): Specialisation El	•		у
	General Engineering Science (German program, 7 semester): Specialisation Program 7 semester): Specialisation Program 7 semester): Specialisation M		•	anulean/
	General Engineering Science (German program, 7 semester): Specialisation M General Engineering Science (German program, 7 semester): Specialisation M			
	General Engineering Science (German program, 7 semester): Specialisation M			
	General Engineering Science (German program, 7 semester): Specialisation in		-	
	Compulsory			5 - 5 -5.5.10
	General Engineering Science (German program, 7 semester): Specialisation	n Mechanical Engineering,	, Focus Theoretical M	Mechanical Engineeri
	la .			
	Compulsory			
	General Engineering Science (German program, 7 semester): Specialisation	Mechanical Engineering,	Focus Product Devel	opment and Producti
		Mechanical Engineering,	Focus Product Devel	opment and Producti
	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Specialisation Compulsory			
	General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation M			
	General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation M Computer Science: Core qualification: Compulsory	Mechanical Engineering, Foc		
	General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation M Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulso General Engineering Science (English program, 7 semester): Specialisation Co	dechanical Engineering, Foc ory omputer Science: Compulso	cus Energy Systems: C	
	General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation M Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulso General Engineering Science (English program, 7 semester): Specialisation Core General Engineering Science (English program, 7 semester): Specialisation Biological Science (English program, 7 semester): Specialisation Science (English program, 7 semester): Specialisation Scien	dechanical Engineering, Foc ory omputer Science: Compulso oprocess Engineering: Com	cus Energy Systems: C ory npulsory	
	General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation M Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulso General Engineering Science (English program, 7 semester): Specialisation Compulsory General Engineering Science (English program, 7 semester): Specialisation Biogeneral Engineering Science (English program, 7 semester): Specialisation Research	dechanical Engineering, Foc ony omputer Science: Compulso oprocess Engineering: Com aval Architecture: Compulso	cus Energy Systems: C ory npulsory ory	
	General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation M Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulso General Engineering Science (English program, 7 semester): Specialisation Compulsor General Engineering Science (English program, 7 semester): Specialisation Bit General Engineering Science (English program, 7 semester): Specialisation Na General Engineering Science (English program, 7 semester): Specialisation Computer Specialisation Science (English program, 7 semester): Specialisation Computer Specialisat	dechanical Engineering, Foc ony omputer Science: Compulso oprocess Engineering: Com aval Architecture: Compulso ivil Engineering: Compulson	cus Energy Systems: Copy ory npulsory ory	
	General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation M Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulso General Engineering Science (English program, 7 semester): Specialisation Compulsory General Engineering Science (English program, 7 semester): Specialisation Biogeneral Engineering Science (English program, 7 semester): Specialisation Research	dechanical Engineering, Foc ony omputer Science: Compulso oprocess Engineering: Com aval Architecture: Compulso ivil Engineering: Compulson ectrical Engineering: Compu	cus Energy Systems: Cony propulsory by y ulsory	

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

General Engineering Science and Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	Course L0321: Computer Engineering		
Тур	cture		
Hrs/wk			
CP	4		
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42		
Lecturer	rof. Heiko Falk		
Language	IE .		
Cycle	WiSe		
Content	Introduction Combinational Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output		
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005. 		

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M1005: Enhanced Fundamentals of Materials Science				
Courses				
Title		Тур	Hrs/wk	CP
Enhanced Fundamentals: Ceramics and Polymers (L1233)		Lecture	2	2
Enhanced Fundamentals: Ceramics and Polymers (L1234)		Recitation Section (large)	1	1
Enhanced Fundamentals: Metals (L1086)		Lecture	2	3
Module Responsible	Prof. Gerold Schneider			
Admission Requirements	None			
Recommended Previous	Module "Fundamentals of Materials Science"			
Knowledge	Module "Materials Science Laboratory"			
	Module "Advanced Materials"			
Educational Objectives	After taking part successfully, students have reached the following learning	g results		
Professional Competence				
Knowledge	The students are able to give an enhanced overview over the following top			
	in metals, polymers and ceramics: Atomic bonds, crystal and amorphous	s structures, defects, electrical and ma	ass transport, m	icrostructure and phase
	diagrams. They are capable to explain the corresponding technical terms.			
Skills Personal Competence Social Competence Autonomy	,			
Western de University	evaluate the profoundness of their knowledge.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6 Written exam			
Examination	written exam			
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Mechanic	and English and an English Materials in En		0
Curricula	General Engineering Science (German program, 7 semester): Special Compulsory General Engineering Science (German program, 7 semester): Specialis Compulsory General Engineering Science (English program): Specialisation Mechanic General Engineering Science (English program, 7 semester): Special Compulsory	isation Mechanical Engineering, Focustation Mechanical Engineering, Focus	Product Develo	Engineering Sciences: opment and Production: ces: Compulsory
	General Engineering Science (English program, 7 semester): Specialis Compulsory Mechanical Engineering: Specialisation Materials in Engineering Science Technomathematics: Specialisation III. Engineering Science: Elective Con Technomathematics: Core qualification: Elective Compulsory	s: Compulsory	Product Develo	opment and Production



Course L1233: Enhanced Fundamer	atale: Caramice and Palumore
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Gerold Schneider, Prof. Bodo Fiedler
Language	DE/EN
Cycle	SoSe
Content	1. Einführung
	Natürliche "Keramiken" - Steine
	"Künstliche" Keramik - vom Porzellan bis zur Hochleistungskeramik Anwendungen von Hochleistungskeramik
	O. Dukumbaratellum
	2. Pulverherstellung
	Einteilung der Pulversyntheseverfahren
	Der Bayer-Prozess zur Al2O3-Herstellung
	Der Acheson-Prozess zur SiC-Herstellung Chemical Vapour Deposition
	Ottermical vapour Deposition
	Pulveraufbereitung
	Mahltechnik
	Sprühtrockner
	3. Formgebung
	Arten der Formgebung Pressen (0 - 15 % Feuchte)
	Gießen (> 25 % Feuchte)
	Plastische Formgebung (15 - 25 % Feuchte)
	4. Sintern
	Triebkraft des Sinterns
	Effekt von gekrümmten Oberflächen und Diffusionswegen
	Sinterstadien des isothermen Festphasensinterns Herring scaling laws
	Heißisostatisches Pressen
	5. Mechanische Eigenschaften von Keramiken
	Elastisches und plastisches Materialverhalten
	Bruchzähigkeit - Linear-elastische Bruchmechanik
	Festigkeit - Festigkeitsstreuung
	6. Elektrische Eigenschaften von Keramiken
	Ferroelektische Keramiken
	Piezo-, ferroelektrische Materialeigenschaften
	Anwendungen
	Keramische Ionenleiter
	Ionische Leitfähigkeit
	Dotiertes Zirkonoxid in der Brennstoffzelle und Lambdasonde
Literature	D R H Jones, Michael F. Ashby, Engineering Materials 1, An Introduction to Properties, Applications and Design, Elesevier
Literature	
	D.W. Richerson, Modern Ceramic Engineering, Marcel Decker, New York, 1992
	W.D. Kingery, Introduction to Ceramics, John Wiley & Sons, New York, 1975
	D.J. Green, An introduction to the mechanical properties of ceramics", Cambridge University Press, 1998
	D. Munz, T. Fett, Ceramics, Springer, 2001
	Polymerwerkstoffe
	Struktur und mechanische Eigenschaften G.W.Ehrenstein;
	Hanser Verlag; ISBN 3-446-12478-0; ca. 20 €
	Kunststoffphysik
	W.Retting, H.M.Laun; Hanser Verlag; ISBN 3446162356; ca. 25 €
	Werkstoffkunde Kunststoffe G.Menges; Hanser Verlag; ISBN 3-446-15612-7; ca. 25 €
	Kunststoff-Kompendium
	A.Frank, K. Biederbick; Vogel Buchverlag; ISBN 3-8023-0135-8; ca.30 €



Course L1234: Enhanced Fundamentals: Ceramics and Polymers	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Gerold Schneider, Prof. Bodo Fiedler
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1086: Enhanced Fundamentals: Metals		
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Jörg Weißmüller, Prof. Patrick Huber	
Language	DE	
Cycle	SoSe	
Content	Enhanced Fundamentals of Metals:	
	 Introduction to phenomenological thermodynamics Elasticity Thermal materials behavior (heat capacity, thermal expansion) Conductors, semiconductors, isolators: conduction mechanisms and band structure Superconductors 	
	 Dry corrosion Electrochemistry in the material sciences Wet corrosion Alloy corrosion Corrosion protection Stainless steel Battery materials Supercapacitors Fuel cells Materials for hydrogen storage Magnetism: phenomenology, Magnetometers, atomistics, micromagnetism Magnetic materials Magnetic materials: applications 	
Literature	Vorlesungsskript	



ourses				
tle		Тур	Hrs/wk	CP
roduction to Management (L0880) oject Entrepreneurship (L0882)		Lecture Problem-based Learning	3 2	3
Module Responsible	Prof. Christoph Ihl	Troblem-based Learning		3
Admission Requirements	·			
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of mar Marketing and Innovation, and also to Investment and Controlling. In		nagement, from Planr	ning and Organisation
	explain the differences between Economics and Management	nt and the sub-disciplines in Managem	ent and to name impo	ortant definitions from t
	field of Management			
	explain the most important aspects of and goals in Managem			
	describe and explain basic business functions as production		chain management, o	organization and hum
	ressource management, information management, innovatio explain the relevance of planning and decision making in		Itiple objectives and	uncertainty, and expla
	some basic methods from mathematical Finance		., ,	3,
	state basics from accounting and costing and selected control	Illing methods.		
Skills	Students are able to analyse business units with respect to Entrepreneurship project in a team. In particular, they are able to	different criteria (organization, objec	tives, strategies etc.) and to carry out
	analyse Management goals and structure them appropriately			
	 analyse organisational and staff structures of companies apply methods for decision making under multiple objectives 	under uncertainty and under risk		
	analyse production and procurement systems and Business			
	analyse and apply basic methods of marketing	•		
	select and apply basic methods from mathematical finance to	predefined problems		
	apply basic methods from accounting, costing and controlling	to predefined problems		
Personal Competence				
Social Competence	Students are able to			
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepreneurs	ship project and write a coherent report	on the project	
	to communicate appropriately and			
	to cooperate respectfully with their fellow students.			
Autonomy	Students are able to			
	work in a team and to organize the team themselves			
	to write a report on their project.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
	6			
Credit points				
Credit points Examination	Written exam			
•				
Examination	90 minutes	ctrical Engineering: Compulsory		
Examination Examination duration and scale	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co	mputer Science: Compulsory		
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro	mputer Science: Compulsory cess Engineering: Compulsory		
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Bio	mputer Science: Compulsory cess Engineering: Compulsory process Engineering: Compulsory	ompulsory	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro	mputer Science: Compulsory icess Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co	. ,	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Bio General Engineering Science (German program): Specialisation Engineering Scienc	mputer Science: Compulsory icess Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co il- and Enviromental Engeneering: Co	. ,	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Bio General Engineering Science (German program): Specialisation En General Engineering Science (German program): Specialisation Civ	mputer Science: Compulsory icess Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co il- and Enviromental Engeneering: Co chanical Engineering: Compulsory	. ,	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Bio General Engineering Science (German program): Specialisation En- General Engineering Science (German program): Specialisation Civ General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Bio General Engineering Science (German program): Specialisation Na	mputer Science: Compulsory icess Engineering: Compulsory process Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co il- and Enviromental Engeneering: Coi chanical Engineering: Compulsory medical Engineering: Compulsory val Architecture: Compulsory	mpulsory	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Bio General Engineering Science (German program): Specialisation En- General Engineering Science (German program): Specialisation Civ General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Na	mputer Science: Compulsory cess Engineering: Compulsory process Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co ill- and Enviromental Engeneering: Cor chanical Engineering: Compulsory medical Engineering: Compulsory val Architecture: Compulsory alisation Electrical Engineering: Comp	ulsory	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Bio General Engineering Science (German program): Specialisation En- General Engineering Science (German program): Specialisation Civ General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Bio General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Speci General Engineering Science (German program, 7 semester): Speci	mputer Science: Compulsory cess Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co il- and Enviromental Engeneering: Co chanical Engineering: Compulsory medical Engineering: Compulsory val Architecture: Compulsory alisation Electrical Engineering: Compul alisation Process Engineering: Compu	ulsory	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Bio General Engineering Science (German program): Specialisation En- General Engineering Science (German program): Specialisation Civ General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Na	mputer Science: Compulsory cess Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co il- and Enviromental Engeneering: Co chanical Engineering: Compulsory medical Engineering: Compulsory val Architecture: Compulsory alisation Electrical Engineering: Compu alisation Process Engineering: Compu alisation Biomedical Engineering: Compu	ulsory lsory pulsory	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Program: Specialisation Program: Specialisation Program: Specialisation Program: Specialisation Bio General Engineering Science (German program): Specialisation En- General Engineering Science (German program): Specialisation Civ General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Na General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Speci General Engineering Science (German program, 7 semester): Speci General Engineering Science (German program, 7 semester): Speci	mputer Science: Compulsory cess Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co il- and Enviromental Engeneering: Co chanical Engineering: Compulsory medical Engineering: Compulsory val Architecture: Compulsory alisation Electrical Engineering: Compu alisation Process Engineering: Compu alisation Biomedical Engineering: Compu alisation Naval Architecture: Compulsory	ulsory lsory npulsory nry	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Program: Specialisation Program: Specialisation Program: Specialisation Program: Specialisation Bio General Engineering Science (German program): Specialisation En- General Engineering Science (German program): Specialisation Civ General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Na General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Speci	mputer Science: Compulsory cess Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co il- and Enviromental Engeneering: Co chanical Engineering: Compulsory medical Engineering: Compulsory val Architecture: Compulsory alisation Electrical Engineering: Comp alisation Process Engineering: Comp alisation Biomedical Engineering: Com alisation Naval Architecture: Compulsor alisation Computer Science: Compulsor	ulsory lsory npulsory ory	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Program: Specialisation Program: Specialisation Program: Specialisation Program: Specialisation Program: Specialisation Ele General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Speci	mputer Science: Compulsory cess Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co chanical Engineering: Compulsory medical Engineering: Compulsory val Architecture: Compulsory alisation Electrical Engineering: Compu alisation Process Engineering: Compu alisation Naval Architecture: Compulsor alisation Computer Science: Compulsor alisation Gomputer Science: Compulsor alisation Bioprocess Engineering: Com alisation Bioprocess Engineering: Com alisation Computer Science: Compulsor	ulsory lsory pulsory pry pry pry pulsory pulsory pry pulsory pulsory	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation End General Engineering Science (German program): Specialisation End General Engineering Science (German program): Specialisation End General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Speci	mputer Science: Compulsory process Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co chanical Engineering: Compulsory medical Engineering: Compulsory val Architecture: Compulsory alisation Electrical Engineering: Compu alisation Process Engineering: Compu alisation Naval Architecture: Compulsor alisation Computer Science: Compulsor alisation Bioprocess Engineering: Com alisation Computer Science: Compulsor alisation Bioprocess Engineering: Com alisation Computer Science: Compulsor alisation Civil Engineering: Compulsor alisation Energy and Enviromental Eng	ulsory lsory pulsory pry pry pry pulsory pulsory pulsory pulsory y gineering: Compulsor	
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation End General Engineering Science (German program): Specialisation End General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Speci	mputer Science: Compulsory process Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Co chanical Engineering: Compulsory medical Engineering: Compulsory val Architecture: Compulsory alisation Electrical Engineering: Compu alisation Process Engineering: Compu alisation Biomedical Engineering: Compu alisation Omputer Science: Compulsor alisation Bioprocess Engineering: Com alisation Computer Science: Compulsor alisation Energy and Enviromental Eng alisation Mechanical Engineering, Foc	ulsory Isory Isory Ipulsory Iry Inpulsory Inpulsor	npulsory
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation End General Engineering Science (German program): Specialisation End General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Na General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Speci	mputer Science: Compulsory cess Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Cor chanical Engineering: Compulsory medical Engineering: Compulsory val Architecture: Compulsory val Architecture: Compulsory alisation Electrical Engineering: Compulsation Process Engineering: Compulsation Biomedical Engineering: Compulsation Naval Architecture: Compulsor alisation Computer Science: Compulsor alisation Bioprocess Engineering: Com alisation Computer Science: Compulsor alisation Civil Engineering: Compulsor alisation Energy and Enviromental Eng alisation Mechanical Engineering, Foc alisation Mechanical Engineering, Foc alisation Mechanical Engineering, Foc alisation Mechanical Engineering, Foc	ulsory Isory Isory Ipulsory Iry Inpulsory Inpulsory Iry Inpulsory Iry Inpulsory Inpuls	npulsory mpulsory
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation En- General Engineering Science (German program): Specialisation En- General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Me General Engineering Science (German program): Specialisation Na General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Speci	mputer Science: Compulsory cess Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Cor chanical Engineering: Compulsory medical Engineering: Compulsory wal Architecture: Compulsory val Architecture: Compulsory alisation Electrical Engineering: Compulsation Process Engineering: Compulsation Biomedical Engineering: Compulsation Naval Architecture: Compulsor alisation Computer Science: Compulsor alisation Givil Engineering: Compulsation Givil Engineering: Compulsor alisation Energy and Enviromental Eng alisation Mechanical Engineering, Foc	ulsory Isory Isory Ipulsory Inpulsory Inpulsory Inpulsory Inpulsory Inpulsory Isory	npulsory mpulsory ngineering: Compulso
Examination Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Specialisation Ele General Engineering Science (German program): Specialisation Co General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation Pro General Engineering Science (German program): Specialisation End General Engineering Science (German program): Specialisation End General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Na General Engineering Science (German program): Specialisation Na General Engineering Science (German program, 7 semester): Speci	mputer Science: Compulsory cess Engineering: Compulsory process Engineering: Compulsory ergy and Enviromental Engineering: Cor chanical Engineering: Compulsory medical Engineering: Compulsory wal Architecture: Compulsory val Architecture: Compulsory alisation Electrical Engineering: Compulsation Process Engineering: Compulsation Biomedical Engineering: Compulsation Naval Architecture: Compulsor alisation Computer Science: Compulsor alisation Givil Engineering: Compulsation Givil Engineering: Compulsor alisation Energy and Enviromental Eng alisation Mechanical Engineering, Foc	ulsory Isory Isory Ipulsory Inpulsory Inpulsory Inpulsory Inpulsory Inpulsory Isory	npulsory mpulsory ngineering: Compulso



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

ompulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

 $\label{thm:condition} \textbf{General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory and the second seco$

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory
General Engineering Science (English program): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Compulsory\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Mechanical\ Engineering,\ M$

General Engineering Science (English program, 7 semester); Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences
Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 $\label{thm:mechanical engineering:Core qualification:Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



	Lecture
Typ	3
Hrs/wk	
	3 Independent Chirly Time 40 Chirly Time in Leadure 40
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	WIGE/303e
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management
	Important definitions from Management,
	 Developing Objectives for Business, and their relation to important Business functions
	Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management
	Marketing and Sales
	Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management
	Definitions as information, information systems, aspects of data security and strategic information systems
	Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Pela access of the define PRR or PRR Medicine. Pela access of the define PRR or PRR Medicine. Pela access of the define PRR or PRR Medicine.
	Relevance of marketing, B2B vs. B2C-Marketing
	different techniques from the field of marketing (e.g. scenario technique), pricing strategies
	important organizational structures basics of human ressource management
	Introduction to Business Planning and the steps of a planning process
	Decision Analysis: Elements of decision problems and methods for solving decision problems
	Selected Planning Tasks, e.g. Investment and Financial Decisions
	Introduction to Accounting: Accounting, Balance-Sheets, Costing
	Relevance of Controlling and selected Controlling methods
	Important aspects of Entrepreneurship projects
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.
	Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Course L0882: Project Entrepreneu	rship
Тур	Problem-based Learning
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,
	using their knowledge from the corresponding lecture.
	Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Focus Mechatronics

In the focus "Mechatronics" students learn next to the knowledge and skills of mechanical engineering deeper knowledge and skills of electrical and mechatronics engineering and are therefore able to solve interdisciplinary problems in mechatronics, those sub-disciplines and related disciplines.

Module M0597: Advanced	Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	CP
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Advanced Mechanical Engineering Design Advanced Mechanical Engineering Design		Lecture	2	2
		Recitation Section (large)		'
Module Responsible				
Admission Requirements	None			
Recommended Previous	Fundamentals of Mechanical Engineering Design			
Knowledge	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the following lea	rning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	explain complex working principles and functions of machine (plaments and of basis alaments of flu	idios	
	explain complex working principles and inficious of machine to explain requirements, selection criteria, application scenarios			
		and practical examples of complex in	lacrime elements,	
	indicate the background of dimensioning calculations.			
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of covered machine ele			
	transfer knowledge learned in the module to new requirement			
	recognize the content of technical drawings and schematic ske	etches,		
	 evaluate complex designs, technically. 			
Personal Competence				
Social Competence				
	Students are able to discuss technical information in the lectur	e supported by activating methods.		
Autonomy				
ricionomy	Students are able to independently deepen their acquired kno	wledge in exercises.		
	Students are able to acquire additional knowledge and to it.	ecapitulate poorly understood conte	ent e.g. by using the	video recordings of
	lectures.			
Workload in Hours	Independent Study Time 69. Study Time in Leature 112			
	Independent Study Time 68, Study Time in Lecture 112			
Credit points Examination	Written exam			
Examination duration and scale	120	harial Fallandar France France) l O l	
Assignment for the Following	General Engineering Science (German program): Specialisation Mec			
Curricula	General Engineering Science (German program): Specialisation Med			
	General Engineering Science (German program): Specialisation Med	0 0,	0	ces: Compulsory
	General Engineering Science (German program): Specialisation Med			
	General Engineering Science (German program): Specialisation Med		·	
	General Engineering Science (German program): Specialisation Med		-	
	General Engineering Science (German program, 7 semester): Specia		-	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering	y, rocus Materials in	Engineering Scienc
	Compulsory Conoral Engineering Science (Gorman program, 7 competer): Specia	lication Machanical Engineering Fra	nuc Mochetreries C	nnulcon
	General Engineering Science (German program, 7 semester): Specia			
	General Engineering Science (German program, 7 semester): Spec	mansation intechanical Engineering,	1 ocus rioduct Devel	opinent and Producti
	Compulsory General Engineering Science (German program, 7 semester): Spe	cialization Machanical Engineering	Focus Theoretical A	Aechanical Engines
	General Engineering Science (German program, 7 semester): Spe Compulsory	oransanon mechanical Engineering	, rocus ineoretical N	лоспанноаг Епдіпееті
	General Engineering Science (German program, 7 semester): Specia	lisation Mechanical Engineering Foo	rus Biomechanice: Co	mnulsory
	General Engineering Science (German program, 7 semester): Specia			
	General Engineering Science (German program, 7 semester): Special General Engineering Science (English program): Specialisation Mech			ompuisory
	General Engineering Science (English program): Specialisation Mech General Engineering Science (English program): Specialisation Mech			Compulsory
	General Engineering Science (English program): Specialisation Mech General Engineering Science (English program): Specialisation Mech			
	General Engineering Science (English program): Specialisation Mech General Engineering Science (English program): Specialisation Mech		-	oos. Compuisory
	General Engineering Science (English program): Specialisation Mech General Engineering Science (English program): Specialisation Mech			luction: Compulsors
	General Engineering Science (English program): Specialisation Mech General Engineering Science (English program): Specialisation Mech		·	
			-	
	General Engineering Science (English program, 7 semester): Special		-	
	General Engineering Science (English program, 7 semester): Spe	ecialisation Mechanical Engineering	J, ⊢ocus Materials in	Engineering Scienc
	Compulsory	testion Machanian Francisco F	Maahaha di C	
	General Engineering Science (English program, 7 semester): Special			
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc			opment and Production	
	Compulsory			
	1			



General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Mechanical Engineering: Core qualification: Compulsory

Naval Architecture: Core qualification: Compulsory

Course L0264: Advanced Mechanic	al Engineering Design II
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	SoSe
Content	Advanced Mechanical Engineering Design I & II
	Lecture
	Fundamentals of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Seals
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank drives
	Sliding bearings
	Elements of fluidics
	Exercise
	Calculation methods of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank gears
	Sliding bearings
	Calculations of hydrostatic systems (fluidics)
Literature	
Literature	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Bücher zu speziellen Themen

Course L0265: Advanced Mechanical Engineering Design II		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0262: Advanced Mechanic	al Engineering Design I
	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	Advanced Mechanical Engineering Design I & II
Content	Advanced Mechanical Engineering Design Facility
	Lecture
	Fundamentals of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Seals
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank drives
	Sliding bearings
	Elements of fluidics
	Exercise
	Calculation methods of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	• Crank gears
	Sliding bearings
	Calculations of hydrostatic systems (fluidics)
Literature	
	 Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	 Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Rücher zu sneziellen Themen
	Sowie weitere Bücher zu speziellen Themen

Course L0263: Advanced Mechanical Engineering Design I		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



ourses	
tle	Typ Hrs/wk CP
	Typ Hrs/wk CP Lecture 3 4
gnals and Systems (L0432) gnals and Systems (L0433)	Recitation Section (large) 1 2
Module Responsible	Prof. Gerhard Bauch
Admission Requirements	None .
Recommended Previous	Mathematics 1-3
Knowledge	manoritation 1 o
	The modul is an introduction to the theory of signals and systems. Good knowledge in maths as covered by the moduls Mathematik 1-3 is exp Further experience with spectral transformations (Fourier series, Fourier transform, Laplace transform) is useful but not required.
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The students are able to classify and describe signals and linear time-invariant (LTI) systems using methods of signal and system theory. They are
	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse deterministic s
	and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image domain which
	caused by the transition of a continuous-time signal to a discrete-time signal.
Skills	The students are able to describe and analyse deterministic signals and linear time-invariant systems using methods of signal and system theory
	can analyse and design basic systems regarding important properties such as magnitude and phase response, stability, linearity etc They can a
	the impact of LTI systems on the signal properties in time and frequency domain.
Personal Competence	
Social Competence	The students can jointly solve specific problems.
Autonomy	The students are able to acquire relevant information from appropriate literature sources. They can control their level of knowledge during the I
	period by solving tutorial problems, software tools, clicker system.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Examination	Written exam
Examination duration and scale	90 min
Assignment for the Following	General Engineering Science (German program): Specialisation Electrical Engineering: Compulsory
Curricula	General Engineering Science (German program): Specialisation Computer Science: Compulsory
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compu
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering (German program, 7 semester): Specialisation (German program, 7
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engine
	Compulsory
	Computer Science: Core qualification: Compulsory
	Electrical Engineering: Core qualification: Compulsory
	General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Computer Science: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compu
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
	Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering
	Compulsory
	Computational Science and Engineering: Core qualification: Compulsory



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	s
Тур	
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle Content	Basic classification and description of continuous-time and discrete-time signals and systems
	Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)
	• Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

Course L0433: Signals and Systems		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Gerhard Bauch	
Language	DE/EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0708: Electrical E	ngineering III: Circuit Theory and Transients			
Courses				
Fitle Fitte		Тур	Hrs/wk	СР
Circuit Theory (L0566)		Lecture	3	4
Circuit Theory (L0567)		Recitation Section (small)	2	2
Module Responsible	Prof. Arne Jacob	(,		
Admission Requirements	none			
Recommended Previous	Electrical Engineering I and II, Mathematics I and II			
Knowledge	Elocatout Engineering Faria II, Maaremaaco Faria II			
····ougo				
Educational Objectives	After taking part successfully, students have reached the following I	earning results		
Professional Competence	51			
Knowledge	Students are able to explain the basic methods for calculating el	ectrical circuits. They know the Fouri	er series analysis of lir	near networks driven b
	periodic signals. They know the methods for transient analysis of			
	frequency behaviour and the synthesis of passive two-terminal-circle			·
Skills	The students are able to calculate currents and voltages in linear r	etworks by means of basic methods,	also when driven by pe	eriodic signals. They ar
	able to calculate transients in electrical circuits in time and frequence	y domain and are able to explain the	respective transient bel	naviour. They are able
	analyse and to synthesize the frequency behaviour of passive two-t	erminal-circuits.		
Personal Competence				
Social Competence	Students work on exercise tasks in small guided groups. They are e	ncouraged to present and discuss the	eir results within the grou	лр.
Autonomy	The students are able to find out the required methods for solving	he given practice problems. Possibilit	ties are given to test the	eir knowledge during th
	lectures continuously by means of short-time tests. This allows the	em to control independently their edu	ıcational objectives. Th	ey can link their gaine
	knowledge to other courses like Electrical Engineering I and Mathe	matics I.		
Westlandin House	Independent Chala Time 140 Chala Time in Leabure 70			
Workload in Hours Credit points	Independent Study Time 110, Study Time in Lecture 70			
Examination	Written exam			
Examination duration and scale	150 min			
Assignment for the Following	General Engineering Science (German program): Specialisation El	ectrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Me		ronics: Compulsorv	
341110414	General Engineering Science (German program, 7 semester): Spec			npulsory
	General Engineering Science (German program, 7 semester): Spec			
	Electrical Engineering: Core qualification: Compulsory	3	. ,	
	General Engineering Science (English program): Specialisation Ele	ctrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Me		onics: Compulsory	
	General Engineering Science (English program, 7 semester): Spec			pulsory
	General Engineering Science (English program, 7 semester): Spec	alisation Electrical Engineering: Com	pulsory	•
	Computational Science and Engineering: Specialisation Engineering	ng Sciences: Elective Compulsory		
	Mechatronics: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Electiv	ve Compulsory		
	Technomathematics: Specialisation III. Engineering Science: Elective	ve Compulsory		



Course L0566: Circuit Theory		
Тур	Lecture	
Hrs/wk	3	
CP	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Arne Jacob	
Language	DE	
Cycle	WiSe	
Content	- Circuit theorems	
	- N-port circuits	
	- Periodic excitation of linear circuits	
	- Transient analysis in time domain	
	- Transient analysis in frequency domain; Laplace Transform	
	- Frequency behaviour of passive one-ports	
Literature	- M. Albach, "Grundlagen der Elektrotechnik 1", Pearson Studium (2011)	
	- M. Albach, "Grundlagen der Elektrotechnik 2", Pearson Studium (2011)	
	- L. P. Schmidt, G. Schaller, S. Martius, "Grundlagen der Elektrotechnik 3", Pearson Studium (2011)	
	- T. Harriehausen, D. Schwarzenau, "Moeller Grundlagen der Elektrotechnik", Springer (2013)	
	- A. Hambley, "Electrical Engineering: Principles and Applications", Pearson (2008)	
	- R. C. Dorf, J. A. Svoboda, "Introduction to electrical circuits", Wiley (2006)	
	- L. Moura, I. Darwazeh, "Introduction to Linear Circuit Analysis and Modeling", Amsterdam Newnes (2005)	

Course L0567: Circuit Theory	
Тур	Recitation Section (small)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Arne Jacob
Language	DE
Cycle	WiSe
Content	see interlocking course
Literature	siehe korrespondierende Lehrveranstaltung
	see interlocking course



Module M1320: Simulation	and Design of Mechatronic Systems			
Courses				
Title		Тур	Hrs/wk	CP
Simulation and Design of Mechatronic Syst		Lecture	2	2
Simulation and Design of Mechatronic Syst		Laboratory	1	2
Simulation and Design of Mechatronic Syst		Recitation Section (large)	1	2
Module Responsible				
· ·	None			
Recommended Previous	Fundatmentals of mechanics, control theory and electrical engineer	ng		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning to the students have reached the students hav	earning results		
Professional Competence				
Knowledge	Students are able to describe methods and calculations for design,	modeling, simulation and optimization	of mechatronic systen	ns.
Chille	Children are alle to analy modern alreadings for modeling of			::
Skills	Students are able to apply modern algorithms for modeling of n	lechaironic systems. They can identi	ny, simulate and des	ign simple systems and
	implement those in laboratory conditions.			
Personal Competence				
Social Competence	Students are able to work goal-oriented in small mixed groups and p	present results to target groups.		
Autonomy	Students are able to recognize and improve knowledge deficits inde	pendently.		
	With instructor assistance, students are able to evaluate their own ke	nowledge level and define a further cou	urse of study.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Mechatro	onics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Aircraft S	Systems Engineering:	Compulsory
	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Theoretic	cal Mechanical Engine	eering: Compulsory
	General Engineering Science (German program, 7 semester): Spec	alisation Mechanical Engineering, Foo	cus Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semester): Spec	alisation Mechanical Engineering, Foo	cus Aircraft Systems E	ngineering: Compulsory
	General Engineering Science (German program, 7 semester): Sp	pecialisation Mechanical Engineering	, Focus Theoretical M	Mechanical Engineering:
	Elective Compulsory			
	General Engineering Science (English program): Specialisation Me	chanical Engineering, Focus Aircraft S	ystems Engineering: (Compulsory
	General Engineering Science (English program): Specialisation Me	chanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (English program): Specialisation Me	chanical Engineering, Focus Theoretic	al Mechanical Engine	ering: Compulsory
	General Engineering Science (English program, 7 semester): Speci	alisation Mechanical Engineering, Foc	us Mechatronics: Con	npulsory
	General Engineering Science (English program, 7 semester): Speci	alisation Mechanical Engineering, Foc	us Aircraft Systems Er	ngineering: Compulsory
	General Engineering Science (English program, 7 semester): Sp	ecialisation Mechanical Engineering	, Focus Theoretical M	Mechanical Engineering:
	Elective Compulsory			
	Mechanical Engineering: Specialisation Aircraft Systems Engineering	g: Compulsory		
	Mechanical Engineering: Specialisation Mechatronics: Compulsory	•		
	Mechanical Engineering: Specialisation Theoretical Mechanical Engineering	gineering: Compulsory		
	Mechatronics: Core qualification: Compulsory			
	weemanomes. Oure quanneagon. Compulsory			

Course L1822: Simulation and Design	gn of Mechatronic Systems
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Uwe Weltin
Language	DE
Cycle	WiSe
Content	Mechatronic Design
	Modeling
	Model Identifikation
	Numerical Methods in simulation
	Applications and examples in Matlab [®] and Simulink [®]
Literature	Skript zur Veranstaltung
	Weitere Literatur in der Veranstaltung



Course L1824: Simulation and Design of Mechatronic Systems	
Тур	Laboratory
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Uwe Weltin
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L1823: Simulation and Design of Mechatronic Systems	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Uwe Weltin
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



courses	_		
itle	Тур	Hrs/wk	CP
omputer Engineering (L0321) omputer Engineering (L0324)	Lecture Recitation Section (small)	3	4
Module Responsible			
Admission Requirements	None		
Recommended Previous	Basic knowledge in electrical engineering		
Knowledge			
	The successful completion of the labs will be honored during the evaluation of the module's examination according	ng to the followir	ng rules:
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due	e to the succes	ssful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge		assembly-leve	el programming dowr
	gates. The module includes the following topics:		,
	• Introduction		
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational netw	rorks	
	Sequential logic: Flip-flops, automata, systematic hardware design Technological foundations		
	Computer arithmetic: Integer addition, subtraction, multiplication and division		
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining		
	Memories: Memory hierarchies, SRAM, DRAM, caches		
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, but	isses	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal stru-		
	computer systems. The students can analyze, how highly specific and individual computers can be built based as		
	components. They are able to distinguish between and to explain the different abstraction layers of today's comp	outing systems	- from gates and circ
	up to complete processors.		
	After successful completion of the module, the students are able to judge the interdependencies between a physical state of the students are able to judge the interdependencies between a physical state of the students are able to judge the interdependencies between a physical state of the students are able to judge the interdependencies between a physical state of the students are able to judge the interdependencies between a physical state of the students are able to judge the interdependencies between a physical state of the students are able to judge the interdependencies between a physical state of the students are able to judge the interdependencies between a physical state of the students are able to judge the interdependencies between a physical state of the students are able to judge the interdependencies between a physical state of the students are able to judge the state of the s	sical computer s	system and the softw
	executed on it. In particular, they shall understand the consequences that the execution of software has on the h	ardware-centric	abstraction layers fr
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstra	action levels ha	
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstract performance and to propose feasible options.	action levels ha	
Personal Competence	performance and to propose feasible options.	action levels ha	
Personal Competence	performance and to propose feasible options.	action levels ha	
Personal Competence Social Competence	performance and to propose feasible options.	action levels ha	
	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly.		
Social Competence Autonomy	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classical contents.		
Social Competence Autonomy Workload in Hours	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other cla		
Social Competence Autonomy Workload in Hours Credit points	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification. Independent Study Time 124, Study Time in Lecture 56		
Social Competence Autonomy Workload in Hours Credit points Examination	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification in the classification of the classification in the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification is a solution of the classification in the classification of the classification is a solution of the classification of the classification is a solution of the classification of the classification is a solution of the classification of th		
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs		
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory		
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification. Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	asses.	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification. Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	asses.	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification. Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	asses.	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification. Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	asses.	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification. Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	asses.	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification in the study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	asses.	ve on an entire syste
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification. Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	asses.	ve on an entire syste
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification. Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory	ry ry ng: Compulsory	ve on an entire syste
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other claim line specific literature and to associate this knowledge with other claim line specific literature and to associate this knowledge with other claim line specific literature and to associate this knowledge with other claim line specific literature and to associate this knowledge with other claim line specific literature and to associate this knowledge with other claim line specific literature and to associate this knowledge with other claim line specific literature and to associate this knowledge with other claim line specific literature and to associate this knowledge with other claim line specific literature and to associate this knowledge with other claim line specific literature and to associate this knowledge with other claim line specific literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with other claim literature and to associate this knowledge with ot	ry ry ng: Compulsory	ve on an entire syste
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other claim literature and to associ	ry ry ng: Compulsory chatronics: Com	ve on an entire syste
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other claim literature and to associ	ry ry ng: Compulsory chatronics: Com mechanics: Cor raft Systems Er	ve on an entire syste / npulsory mpulsory ngineering: Compulso
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other claim land to accord to accord to accord to a constant the claim land to associate this knowledge with other claim land to associate this knowledge with claim land to associate thi	ry ry ng: Compulsony chatronics: Com mechanics: Cor raft Systems Er us Materials in	rve on an entire syste r npulsory mpulsory mgineering: Compulso Engineering Science
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other claim literature and to associate this knowledge with charical Engineering. Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Medeneral Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical	ry ry ng: Compulsony chatronics: Com mechanics: Cor raft Systems Er us Materials in	rve on an entire syste r npulsory mpulsory mgineering: Compulso Engineering Science
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification are able to acquire new knowledge from specific literature and to associate this knowledge with other classification are able to acquire new knowledge from specific literature and to associate this knowledge with other classification are applied to associate this knowledge with other classification are applied to associate this knowledge with other classification are applied to associate this knowledge with other classification are applied to associate this knowledge with other classification and chanical and control associate and the chanical and control associate and the chanical and control associate and control associate and to associate this knowledge with other classification associate this knowledge with other classification associate this knowledge with other classification and chanical and control and program program, 7 semester): Specialisation Mechanical Engineering, Focus Medeneral Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Medeneral Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aird General Engineering Science (German program, 7 semester): Specialisation Mechanical Enginee	ry ry chatronics: Com mechanics: Cor raft Systems Er us Materials in s Theoretical M	re on an entire syste repulsory mpulsory mpulsory: Compulsory Engineering: Compulsor Engineering Science
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other claim line of the content of t	ry ry chatronics: Com mechanics: Cor raft Systems Er us Materials in s Theoretical M	re on an entire syste repulsory mpulsory mpulsory: Compulsory Engineering: Compulsor Engineering Science
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classification are able to acquire new knowledge from specific literature and to associate this knowledge with other classification are able to acquire new knowledge from specific literature and to associate this knowledge with other classification are able to acquire new knowledge from specification: Computer Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bio General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bio General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus General Engineering Science (German program, 7 semester): Specialisation Mechanical E	ry ry ry ng: Compulsory chatronics: Com mechanics: Cor raft Systems Er us Materials in s Theoretical M	re on an entire syste repulsory mpulsory mpulsory: Compulsory gineering: Compulsor Engineering Science flechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other claim contents are able to acquire new knowledge from specific literature and to associate this knowledge with other claim contents are able to acquire new knowledge from specific literature and to associate this knowledge with other claim contents are able to acquire new knowledge from specific literature and to associate this knowledge with other claim contents are able to acquire new knowledge from specific literature and to associate this knowledge with other claim contents are able to acquire new knowledge from specific literature and to associate this knowledge with other claim contents are able to acquire new knowledge from specific literature and to associate this knowledge with other claim contents are able to acquire new and to associate this knowledge with other claim contents are able to acquire and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and the same and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claim contents and to associate this knowledge with other claims and to associate thi	ry ry ry ng: Compulsory chatronics: Com mechanics: Cor raft Systems Er us Materials in s Theoretical M	re on an entire syste repulsory mpulsory mpulsory: Compulsory gineering: Compulsor Engineering Science flechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other claim of the claim of t	ry ry ry ng: Compulsory chatronics: Com mechanics: Cor raft Systems Er us Materials in s Theoretical M	re on an entire syste repulsory mpulsory mpulsory: Compulsory gineering: Compulsor Engineering Science flechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other click independent Study Time 124, Study Time in Lecture 56 Mritten exam 90 minutes, contents of course and labs General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Dioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Met General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Met General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Met General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Met General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Met General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester):	ry ry ry ng: Compulsory chatronics: Com mechanics: Cor raft Systems Er us Materials in s Theoretical M	re on an entire syste repulsory mpulsory mpulsory: Compulsory gineering: Compulsor Engineering Science flechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other click independent Study Time 124, Study Time in Lecture 56 Beautiful Study Time 124, Study	ry ry ry ng: Compulsory chatronics: Com mechanics: Cor raft Systems Er us Materials in s Theoretical M	re on an entire syste repulsory mpulsory mpulsory: Compulsory gineering: Compulsor Engineering Science flechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other click independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineer General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mec General Engineering Science (German program, 7 semester): Specialisation Mechanical En	ry ry ry rg: Compulsory mechanics: Corr mechanics: Corr staff Systems Er us Materials in s Theoretical M Product Develo	re on an entire syste repulsory mpulsory mpulsory: Compulsory gineering: Compulsor Engineering Science flechanical Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other claim control of the control	ry ry ry rg: Compulsory mechanics: Corr mechanics: Corr staff Systems Er us Materials in s Theoretical M Product Develo	npulsory mpulsory mpulsory mgineering: Compulso Engineering Science flechanical Engineering
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other click independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bio General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bio General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bio General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bio General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bio General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Bio General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Compulsory General Engineering Science (German program, 7 semester): Specialisation Me	ry ry ry rg: Compulsory mechanics: Corr mechanics: Corr staff Systems Er us Materials in s Theoretical M Product Develo	npulsory mpulsory mpulsory mgineering: Compulso Engineering Science flechanical Engineering
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	performance and to propose feasible options. Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other claim control of the control	ry ry ry rg: Compulsory mechanics: Corr mechanics: Corr staff Systems Er us Materials in s Theoretical M Product Develo	re on an entire syste repulsory mpulsory mpulsory: Compulsory gineering: Compulsor Engineering Science flechanical Engineeri

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

General Engineering Science and Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	Course L0321: Computer Engineering	
Тур	Lecture	
Hrs/wk	3	
CP	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Heiko Falk	
Language	DE	
Cycle	WiSe	
Content	Introduction Combinational Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output	
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005. 	

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses			
ïtle	Typ Hrs/w	vk	CP
troduction to Control Systems (L0654)	Lecture 2 Recitation Section (small) 2		2
troduction to Control Systems (L0655)			2
Module Responsible			
Admission Requirements			
Recommended Previous			
Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	 Students can represent dynamic system behavior in time and frequency domain, and can in particular explain pro 	operties of f	rst and second on
	systems	opooo o	
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency responses.	ponse and i	oot locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.		
	They can explain the role of the phase margin in analysis and synthesis of control loops		
	They can explain the way a PID controller affects a control loop in terms of its frequency response		
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally		
Skills	Students can transform models of linear dynamic systems from time to frequency domain and vice versa		
	They can simulate and assess the behavior of systems and control loops		
	They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules		
	They can analyze and synthesize simple control loops with the help of root locus and frequency response techniq	ques	
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital in	mplementat	ion
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks		
Personal Competence			
Social Competence			
Autonomy		and use it	when solving give
	problems.		
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Examination	Written exam		
Examination duration and scale	120 min		
Assignment for the Following			
	General Engineering Science (German program): Core qualification: Compulsory		
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory		
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory		
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory		
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory		
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	mpulsory	
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	mpulsory	
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory		Isory
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Congeneral Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	ics: Compu	-
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni	iics: Compu nics: Compu	ılsory
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechan	nics: Compu nics: Compu stems Engir	ulsory neering: Compulso
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechar General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys	nics: Compu nics: Compu stems Engir	ulsory neering: Compulso
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys	nics: Compu nics: Compu stems Engir erials in Er	ulsory leering: Compulso ligineering Scienc
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory	nics: Compu nics: Compu stems Engir erials in Er	ulsory leering: Compulso ligineering Scienc
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory neering: Compulso gineering Scienc nanical Engineeri
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechan General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory neering: Compulso gineering Scienc nanical Engineeri
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechar General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering: Core qualification: Compulsory	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechar General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualificati	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Disprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Disprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Disprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Congulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechar General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering Science (Eng	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Congulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compuls	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechar General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory Genera	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory leering: Compulso gineering Science nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering: Core qualification: Compulsory General Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General En	nics: Compu nics: Compu stems Engir erials in Er retical Mecl	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mate Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theor Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester	nics: Compu nics: Compu stems Engir erials in Er retical Mecl ct Developn	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Dioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroni General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sys General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sys Bioprocess Engineering Science (English program, 7 semester): Specialisation Compulsory General Engineering Science (English program, 7 semester): Sp	ics: Compunics: Compunics: Compustems Engirerials in Erretical Medical Developm	ulsory leering: Compulso gineering Scienc nanical Engineeri nent and Producti



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

Тур	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems
	Linear systems, differential equations and transfer functions
	 First and second order systems, poles and zeros, impulse and step response Stability
	Stability
	Feedback systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Root locus techniques
	Post logge plate
	Root locus plots Root locus design of PID controllers
	Troot locas design of the controllers
	Frequency response techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation
	Frequency response interpretation of PID control
	Time delay systems
	Root locus and frequency response of time delay systems
	Smith predictor
	Digital control
	Sampled-data systems, difference equations
	Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers
	Tuber approximation, digital implementation of FID controllers
	Software tools
	Introduction to Matlab, Simulink, Control toolbox
	Computer-based exercises throughout the course
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010



ourse L0655: Introduction to Control Systems	
Тур	Recitation Section (small)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0777: Semicondu	ctor Circuit Design			
Courses				
Title		Тур	Hrs/wk	CP
Semiconductor Circuit Design (L0763)		Lecture	3	4
Semiconductor Circuit Design (L0864)		Recitation Section (small)	1	2
Module Responsible	NN			
Admission Requirements	none			
Recommended Previous	Fundamentals of electrical engineering			
Knowledge	Basics of physics			
	basics of physics			
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	Students are able to explain the functionality of different	MOS devices in electronic circuits		
	Students are able to explain the functionality of different Students know the fundamental digital logic circuits and		ntages	
	Students have solid knowledge about memory circuits an			
	Students are able to explain how analog circuits function			
	Students know the appropriate fields for the use of bipolar			
Skills				
	 Students can calculate the specifications of different MOS 		of electronic circuits.	
	Students are able to develop different logic circuits and containing the students are able to develop different logic circuits and containing the students are able to develop different logic circuits and containing the students are able to develop different logic circuits and containing the students are able to develop different logic circuits and containing the students are able to develop different logic circuits and containing the students are able to develop different logic circuits. - The students are able to develop different logic circuits and containing the students are able to develop different logic circuits and containing the students are able to develop different logic circuits and containing the students are able to develop different logic circuits and containing the students are able to develop different logic circuits and containing the students are able to develop different logic circuits and containing the students are able to develop different logic circuits and containing the students are also developed the students are also developed to the students are also developed the students are also developed the students are also developed to the students are also developed the students are also developed to the students are also developed			
	 Students can use MOS devices, operational amplifiers a 	nd bipolar transistors for specific application	ons.	
Personal Competence				
Social Competence	Students are able work efficiently in heterogeneous tean	ns.		
	Students working together in small groups can solve pro		5.	
Autonomy				
	 Students are able to assess their level of knowledge. 			
Weddedballere	Indiana day On d. Ton 404 On d. Ton indiana 50			
Workload in Hours Credit points	Independent Study Time 124, Study Time in Lecture 56			
Examination	Written exam			
Examination duration and scale	120 min			
		a Floatrical Engineering: Compularing		
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation		onice: Compulsory	
Curricula	General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester): S			pulsory
	Electrical Engineering: Core qualification: Compulsory	F = 1.2out Engineering, I of		
	General Engineering Science (English program): Specialisation	Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation	0 0 1 ,	onics: Compulsorv	
	General Engineering Science (English program, 7 semester): Sp	•		
	General Engineering Science (English program, 7 semester): Sp			oulsory
	Mechanical Engineering: Specialisation Mechatronics: Compuls			•
	Mechatronics: Core qualification: Compulsory	•		
l				
	Technomathematics: Core qualification: Elective Compulsory			



Course L0763: Semiconductor Circu	uit Design
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	NN
Language	DE
Cycle	SoSe
Content	 Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Scaling-down of CMOS circuits and further perfomance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits From the summer semester 2017 onwards, students have the possibility to get a bonus of 0,3 to 0,7 for improving the (passed) exam by writing a test on either the 16.05., 13.06. or the 04.07.2017. The test includes 10 questions (time limit: 20 min.).
Literature	R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 3519004674 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944 U. Tietze und Ch. Schenk, E. Gamm, Halbleiterschaltungstechnik, Springer Verlag, 14. Auflage, 2012, ISBN 3540428496 H. Göbel, Einführung in die Halbleiter-Schaltungstechnik, Berlin, Heidelberg Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208874 ISBN: 9783642208867 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 URL: http://ebooks.ciando.com/book/index.cfm/bok_id/319955 URL: http://www.ciando.com/img/bo



Hrs/Wk CP 2 Workload in Hours Independent Study Time 46, Study Time in Lecture 14 Lecturer Language DE Cycle SoSe Content Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Scaling-down of CMOS circuits and further perfomance improvements Operational amplifiers and their applications Basic circuits with biploal transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits Literature R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 35191 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944 U. Tietze und Ch. Schenk, E. Gamm, Halbleiterschaltungstechnik, Springer Verlag, 14. Auflage, 2012, ISBN 3540428496
Workload in Hours Independent Study Time 46, Study Time in Lecture 14 Lecturer NN Language DE Cycle SoSe Content Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Scaling-down of CMOS circuits and further perfomance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits Electrical behavoir of BiCMOS circuits Literature R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 35196 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944
Workload in Hours Lecturer NN Language Cycle SoSe Content Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Scaling-down of CMOS circuits and further perfomance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits Literature R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 35194 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944
Lecturer Language Cycle SoSe Content Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Scaling-down of CMOS circuits and further performance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits Electrical behavoir of BiCMOS circuits HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 35196 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944
Language DE Cycle SoSe Content Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Scaling-down of CMOS circuits and further perfomance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits Electrical behavoir of BiCMOS circuits HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 35196 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944
Content Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Scaling-down of CMOS circuits and further perfomance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits Literature R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 35194 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944
Content Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Scaling-down of CMOS circuits and further perfomance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 35196 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944
Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Scaling-down of CMOS circuits and further perfomance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits B. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 35196 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944
H. Göbel, Einführung in die Halbleiter-Schaltungstechnik, Berlin, Heidelberg Springer-Verlag Berlin Heidelberg, 2011, ISBN: 97836422088 9783642208867 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 URL: http://ebooks.ciando.com/book/index.cfm/bok_id/319955 URL: http://www.ciando.com/img/bo



Module M0854: Mathematic	es IV				
Courses					
Title			Тур	Hrs/wk	СР
Differential Equations 2 (Partial Differential	Equations) (L1043)		Lecture	2	1
Differential Equations 2 (Partial Differential			Recitation Section (small)	1	1
Differential Equations 2 (Partial Differential Complex Functions (L1038)	Leguations) (L1045)		Recitation Section (large) Lecture	1 2	1
Complex Functions (L1041)			Recitation Section (small)	1	1
Complex Functions (L1042)			Recitation Section (large)	1	1
Module Responsible	Prof. Anusch Taraz				
Admission Requirements	none				
Recommended Previous	Mathematics 1 - III				
Knowledge					
Educational Objectives	After taking part successfully, students have reached the fo	ollowing learning i	results		
Professional Competence					
Knowledge	Charles and respect the basis assessed in Mathematica	ation IV/ There are			
	Students can name the basic concepts in Mathema Students can discuss logical connections between				ith the help of examples
	They know proof strategies and can reproduce the	·	mey are capable of musicating to	iese comiections w	iti tile lielp of examples.
	They know proof strategies and san reproduce the				
Skills					
	Students can model problems in Mathematics IV w	vith the help of the	concepts studied in this course.	Moreover, they are	capable of solving then
	by applying established methods.				
	Students are able to discover and verify further logical controls.				
	For a given problem, the students can develop and	d execute a suitabl	e approach, and are able to critic	cally evaluate the re	esults.
Personal Competence					
Social Competence	Students are able to work together in teams. They a	are capable to use	mathematics as a common lang	juage.	
	In doing so, they can communicate new concepts				can design examples to
	check and deepen the understanding of their peers	S.			
Autonomy					
	Students are capable of checking their understand	ding of complex c	oncepts on their own. They can	specify open ques	tions precisely and knov
	where to get help in solving them.				
	Students have developed sufficient persistence to limit to the students have developed sufficient persistence to limit to the students have developed sufficient persistence to limit to the students have developed sufficient persistence to limit to the students have developed sufficient persistence to limit to the students have developed sufficient persistence to limit to the students have developed sufficient persistence to limit to the students have developed sufficient persistence.	be able to work for	r longer periods in a goal-oriente	d manner on hard p	problems.
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112				
Credit points	6				
Examination	Written exam				
Examination duration and scale	60 min (Complex Functions) + 60 min (Differential Equatio	ons 2)			
Assignment for the Following	General Engineering Science (German program): Speciali	isation Electrical E	Engineering: Compulsory		
Curricula	General Engineering Science (German program): Special	lisation Mechanica	l Engineering, Focus Mechatron	ics: Compulsory	
	General Engineering Science (German program): Speciali	lisation Mechanica	l Engineering, Focus Theoretica	l Mechanical Engin	eering: Compulsory
	General Engineering Science (German program): Speciali	isation Naval Arch	itecture: Compulsory		
	General Engineering Science (German program, 7 semes	ster): Specialisation	n Electrical Engineering: Compu	sory	
	General Engineering Science (German program, 7 semes				
	General Engineering Science (German program, 7 sem	nester): Specialisa	tion Mechanical Engineering, F	ocus Theoretical I	Mechanical Engineering
	Compulsory	1-2-0	Niconi Angletona		
	General Engineering Science (German program, 7 semes	<i>'</i> .		у	
	Computer Science: Specialisation Computational Mathem	iatics: Elective Cor	ripulsory		
	Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specialis	sation Flectrical F	ngineering: Compulsory		
	General Engineering Science (English program): Specialist General Engineering Science (English program): Specialist				
	General Engineering Science (English program): Specialist General Engineering Science (English program): Specialist			cs: Compulsory	
	General Engineering Science (English program): Specialis		-		eering: Compulsory
	General Engineering Science (English program, 7 semest		-	-	3 - 5
	General Engineering Science (English program, 7 semest				npulsory
	General Engineering Science (English program, 7 sem				
	Compulsory		- 0		
	General Engineering Science (English program, 7 semest	ter): Specialisation	Naval Architecture: Compulsory	,	
	Computational Science and Engineering: Specialisation E	Engineering Scien	ces: Elective Compulsory		
1	Computational Science and Engineering: Specialisation C	Computer Science	: Elective Compulsory		
	Mechanical Engineering: Specialisation Theoretical Mech	nanical Engineerin	g: Compulsory		
	Mechanical Engineering: Specialisation Mechatronics: Co	ompulsory			
	Mechatronics: Core qualification: Compulsory				
	Naval Architecture: Core qualification: Compulsory				
	Theoretical Mechanical Engineering: Technical Compleme	entary Course Co	re Studies: Elective Compulsory		



Course L1043: Differential Equation	s 2 (Partial Differential Equations)
Тур	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	Main features of the theory and numerical treatment of partial differential equations
	 Examples of partial differential equations First order quasilinear differential equations Normal forms of second order differential equations Harmonic functions and maximum principle Maximum principle for the heat equation Wave equation Liouville's formula Special functions Difference methods Finite elements
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html

Course L1044: Differential Equation	purse L1044: Differential Equations 2 (Partial Differential Equations)	
•	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

course L1045: Differential Equations 2 (Partial Differential Equations)	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1038: Complex Functions	
Тур	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	Main features of complex analysis
	Functions of one complex variable Complex differentiation Conformal mappings Complex integration Cauchy's integral theorem Cauchy's integral formula Taylor and Laurent series expansion Singularities and residuals Integral transformations: Fourier and Laplace transformation
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html



Course L1041: Complex Functions	ourse L1041: Complex Functions	
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1042: Complex Functions	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



urses				
le		Тур	Hrs/wk	CP
oduction to Management (L0880) pject Entrepreneurship (L0882)		Lecture Problem-based Learning	3	3
Module Responsible	Prof. Christoph Ihl	1 Toblem Sasca Ecarring	2	-
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of Marketing and Innovation, and also to Investment and Controlling		ınagement, from Planı	ning and Organisation
Skills	explain the differences between Economics and Manager field of Management explain the most important aspects of and goals in Manager describe and explain basic business functions as productions as productions. explain the relevance of planning and decision making some basic methods from mathematical Finance state basics from accounting and costing and selected continuous states as the production and particular, they are able to analyse business units with respect the Entrepreneurship project in a team. In particular, they are able to analyse Management goals and structure them appropriation analyse organisational and staff structures of companies apply methods for decision making under multiple object analyse production and procurement systems and Business.	gement and name the most important asp uction, procurement and sourcing, supply ration management and marketing in Business, esp. in situations under man controlling methods. to different criteria (organization, object) ately	ects of entreprneurial procession of entreprneurial procession of the contract	orojects organization and hum uncertainty, and expla
Personal Competence	analyse and apply basic methods of marketing select and apply basic methods from mathematical finance apply basic methods from accounting, costing and control			
Social Competence	Students are able to			
Autonomy	work successfully in a team of students to apply their knowledge from the lecture to an entreprent to communicate appropriately and to cooperate respectfully with their fellow students. Students are able to work in a team and to organize the team themselves	eurship project and write a coherent repo	t on the project	
	to write a report on their project.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation	Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	Process Engineering: Compulsory Bioprocess Engineering: Compulsory Energy and Environmental Engineering: Co Civil- and Environmental Engeneering: Co Mechanical Engineering: Compulsory Biomedical Engineering: Compulsory	. ,	
	General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Specialisation General Engineering Science (German program, 7 semester): Special Engineering Science (German program, 7 semester)	pecialisation Electrical Engineering: Comp pecialisation Process Engineering: Comp pecialisation Biomedical Engineering: Co pecialisation Naval Architecture: Compuls pecialisation Computer Science: Compuls pecialisation Bioprocess Engineering: Co pecialisation Civil Engineering: Compulso pecialisation Energy and Enviromental Er pecialisation Mechanical Engineering, Fo pecialisation Mechanical Engineering, Fo	ulsory mpulsory sory mpulsory mpulsory ory ngineering: Compulsor cus Mechatronics: Cor cus Biomechanics: Co	mpulsory mpulsory



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

ompulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

 $\label{thm:control_general} \textbf{General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory and Compulso$

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program); Specialisation Energy and Environmental Engineering; Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester); Specialisation Computer Science; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Compulsory\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Mechanical\ Engineering,\ M$

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 $\label{thm:mechanical engineering:Core qualification:Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Hrs/wk 3 CP 3 Workload in Hours Ind Lecturer Pro Ker Language DE	dependent Study Time 48, Study Time in Lecture 42 rof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgan
CP 3 Workload in Hours Ind Lecturer Pro Ker Language DE	rof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgan
Workload in Hours Ind Lecturer Pro Kei Language DE	rof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgan
Lecturer Pro Kei Language DE	rof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgan
Language DE	
Language DE	. B (M W) M B (T) W
. 33.	ersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Cycle Mis	E
Cycle Wis	iSe/SoSe
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects
Literature Bar	amberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
Eis	senführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
He	einhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
Kru	ruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
Pel	ellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
Sch	chweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
We	eber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.
We	eber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Course L0882: Project Entrepreneu	rship
Тур	Problem-based Learning
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept, using their knowledge from the corresponding lecture. Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Focus Product Development and Production

The specialization Product Development and Production in the field of study Mechanical Engineering of the course of study General Engineering Science enables a consecutive study of the master Product Development and Production. The specialization maps the product creation process from systematic and methodical development of products, including concept development, design, utilisation of 3D-CAD and Product data management systems, material selection, simulation and test to production, the planning and control and the use of modern manufacturing processes, to high-performance materials.

Security of the control of the contr		Mechanical Engineering Design			
Advisoror Competence Foressonal Competence Analysis of Competence Competenc	Courses				
Advanced Newhord Informacy (1,000%) (1,	Title		Тур	Hrs/wk	СР
Automote Mentanes Pignovery (10/89) (10/89) Publisher Regional Publisher Regional Publisher Regional Publisher Regional Publisher Regional Publisher Regional Regional Publisher Regional Region	Advanced Mechanical Engineering Design	II (L0264)	Lecture	2	2
Modular Reportable To Underwind Engineering Modular Reportable Policy Description of Management Po	Advanced Mechanical Engineering Design	II (L0265)	Recitation Section (large)	2	1
Motion Responsible Adhistion Requirements of Notice Recommended of versions Knowledge - Indicational Objective Recommended of Versions Recommended of Versions - Fundamentals of Materials Science - Production Engineering Educational Objective Recommended of Materials Science - Production Engineering Educational Objective Recommended of Materials Science - Production Engineering Educational Objective Recommended of Materials Science - Production Engineering - Recommended of Materials Science - Production Engineering - Recommended of Materials Science - Production Engineering - After passing the module, students are able to: - Indicate the background of dimensioning calculations of machine elements and of basis elements of fluidoc explain requirements adecident coffers, application scenarios and practical examples of complex machine elements Indicate the background of dimensioning calculations of acadimic elements - Indicate the background of dimensioning calculations of covered machine elements Indicate the background of dimensioning calculations of covered machine elements Indicate the background of dimensioning calculations of covered machine elements Indicate the background of commensioning calculations of covered machine elements Indicate the background of elements of covered machine elements Indicate the background of elements of covered machine elements Indicate the background of elements of covered machine elements Indicate the background of elements of covered machine elements Indicate the background of elements of covered machine elements Indicate the background of elements of the elements of the elements Indicate the background of elements of the elements of the elements Indicate the background of elements of the elements Indicate the background of elements of the elements Indicate the background of elements of the elements of the elements Indicate the background of elements of the elements of the elements Indicate the elements of the elements of the e					2
Recommended Previous	Advanced Mechanical Engineering Design	I (L0263)	Recitation Section (large)	2	1
Production Topingering Educational Objectives	Module Responsible	Prof. Dieter Krause			
* Fundamentals of Medicanical Engineering Design * Educational Objectives * Fundamentals of Medicanical Engineering * Fundamentals of Medicanical Engineering Engineering General Engineering Compution * engineering Medicanical Engineering Calculations of machine elements and of basic elements of Buildica, * engineering Personal Computers * indicate the background of dimensioning calculations * International Engineering Calculations of Concrete machine elements * indicate the background of dimensioning calculations * international Engineering Calculations of Concrete machine elements * indicate the background of dimensioning calculations * international Engineering Calculations * international Engineering Calculations of Concrete machine elements * Students are able to discuss sectorical information in the lecture supported by addividual prefered. * Students are able to discuss sectorical information in the lecture supported by addividual prefered. * Students are are able to discuss sectorical information in the lecture supported by addividual prefered. * Students are are able to independently deseived information in the lecture supported by addividual prefered by additional prefered by additional prefered by addit	Admission Requirements	None			
** Mechanics ** Mechanics ** Professional Objectives ** Professional Comprisere ** Addressing the module, students are ade to comprise the control of professional comprisere and professional Comprisere ** Students are able to independently deepen their acquisements and tasks (problems solving skills), ** Professional Comprisere ** Students are able to independently deepen their acquised knowledge in exercises ** Students are able to independently deepen their acquised knowledge in exercises ** Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of rigidates and able to independently deepen their acquised knowledge in exercises ** Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of rigidates and acquired in a	Recommended Previous				
Educational Objectives Professional Competence Nowledge After passing the module, students are able to: explain requirements, selection criteria, applications correspond practices examples of complete machine elements and of basic elements of fluidics. explain requirements, selection criteria, applications correspond practical examples of complete machine elements. indicate the basicypurous of dimensioning calculations. Sixilia After passing the module, students are able to: explain requirements, selection criteria, applications carriants and practical examples of complete machine elements. indicate the basicypurous of dimensioning calculations. Sixilia After passing the module, students are able to: explain requirements, selection criteria, applications carriants and states (problem solving skills). explain requirements are able to: explain requirements are able to: explain requirements are able to: explain requirements are able to discuss technically. Personal Competence Social Competence Social Competence Social Competence Social Competence Soc	Knowledge				
Educational Objectives Professional Competence Knowledge Alter taking parts uccessfully, students have reached the following learning results Professional Competence Knowledge Alter passing the module, students are able to: • explain comprise working principles and functions of machine elements and or basic elements of fluidics, • explain requirements, election clients, applications comands and practical examples of complex machine elements, • indicate the background of dimensioning calculations. Skillar Alter passing the module, students are able to: • explain complex working planning and advantage and practical examples of complex machine elements, • indicate the background of dimensioning calculations. Alter passing the module, students are able to: • recognize the content of the chinical divinings and schematic elements. • recognize the content of the chinical divinings and schematic elements. • recognize the content of the chinical divinings and schematic elements. • Students are able to discuss technically. • Students are able to discuss technically in the following and schematic elements are provided by activating methods. **Workload in Hours Workload in Hours Workload in Hours **Workload in Hours **Descriptions** **Production** **Workload in Hours **Creatispoints** **Descriptions** **Examination Witten exam **Examination Witten exam **Examination **Curricus **Creatispoints** **Creatispoints** **Creatispoints** **Curricus **Curricus **Curricus **Curricus **Curricus **Creatispoints** **Curricus **Carricus Engineering Science (Comman program), Specialisation Mechanical Engineering, Foous Mechanics Compulsory **Central Engineering Science (Comman program), Specialisation Mechanical Engineering, Foous Mechanics Compulsory **Central Engineering Science (Comman program), 7 semester): Specialisation Mechanical Engineering, Foous Mechanics Compulsory **Central Engineering Science (Comman program), 7 semester): Specialisation Mechanical Engineering, Foous Mechanics Compulsor					
Educational Objectives Professional Competence Knowledge After passing the module, acudents are able to: explain complex working principles and functions of machine elements and of basic elements of fluidice, explain complex working principles and functions of machine elements and of basic elements of fluidice, explain complex working principles and functions of machine elements and or basic elements of fluidice, explain requirements, selection orbitests, againstances and practical examples of complex machine elements, includes the basic/pound of dimensioning collustrations of covered machine elements. Actor passing the module, students are able to: excomplish dimensioning collustrations of covered machine elements. excount of the content of technical drawings and schematic selectives. explain requirements of the content of technical drawings and schematic selectives. explained completence Social Competence Competence Competence Competence Competence Competence Competence Competence					
Professional Competence Knowledge After passing the module, students are able to: - explain complex working principles and fundions of machine elements and of basic elements of fluidice explain complex working principles and fundions of machine elements and of basic elements of fluidice explain requirements, selection contents, applications acervates and practical examples of complex machine elements, - indicate the background of dimensioning calculations. Stalls After passing the module, students are able to: - accomplish dimensioning calculations of covered machine elements, - transfer howledge learned in the module to new requirements and tasks. (problem solving skills), - recognize the content of detrined arriving and schematic sketches evaluate complex designs, technically. Personal Competence Social Competence - Soci		Production Engineering			
Professional Competence Knowledge After passing the module, students are able to: - explain complex working principles and fundions of machine elements and of basic elements of fluidice explain complex working principles and fundions of machine elements and of basic elements of fluidice explain requirements, selection contents, applications acervates and practical examples of complex machine elements, - indicate the background of dimensioning calculations. Stalls After passing the module, students are able to: - accomplish dimensioning calculations of covered machine elements, - transfer howledge learned in the module to new requirements and tasks. (problem solving skills), - recognize the content of detrined arriving and schematic sketches evaluate complex designs, technically. Personal Competence Social Competence - Soci	Educational Objectives	After taking part successfully, students have reached the follo	wing learning results		
After passing the module, students are able to:		The laking part successions, stadents have reached the folio	wing learning results		
explain complex working principles and functions of machine elements and of basic elements of fluidics, explain requirements, selection criteria, applications scenarios and practical examples of complex machine elements, indicate the basoprium of dimensioning activations: Stalls After passing the module, students are able to: excoupling the content of functioning activations of covered machine elements, inandar knowledge learned in the module to new requirements and tasks (problem solving skills), recognize the content of functioning and schematic selections, evaluate complex designs, technically. Personal Competence Social Competence Social Competence Social Competence Social Competence - Students are able to discuss technical information in the lecture supported by activating methods. Autonomy - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to discuss technical information in the lecture supported by activating methods. The activation of the following in the students of the lectures of the students. Workload in Neurs. - Students are able to discuss technical information in the lecture supported by activating methods. - Students are able to discuss technical information in the lecture supported by activating methods. - Students are able to discuss technical information in the lecture supported by activating methods. - Students are able to discuss technical information in the lecture supported by activating methods.					
	Knowledge	After passing the module, students are able to:			
		 explain complex working principles and functions of n 	nachine elements and of basic elements of flu	idics,	
Personal Competence Social Co					
Autonomy Autonomy Workload in Hours Curricute Curri			·	,	
accomplish dimensioning calculations of covered machine elements, transfer knowledge learned in the module to new requirements and tasks (problem solving skills), recognize the content of orbinical drawings and schematic skritches, evaluate complex designs, technically. Personal Competence Social Competence Social Competence - Students are able to discuss technical information in the lecture supported by activating methods. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge in exercises. - Students are able to independently deepen their acquired knowledge and to recapital and their acquired knowledge and to recapital knowledge and to recapital knowledge		3 · · · · · · · · · · · · · · · · · · ·			
Personal Competence Social Competence Social Competence Autonomy • Students are able to discuss technical information in the lecture supported by activating methods. • Students are able to discuss technical information in the lecture supported by activating methods. • Students are able to discuss technical information in the lecture supported by activating methods. • Students are able to independently deepen their acquired knowledge in exercises. • Students are able to acquire additional knowledge and to recapitulate poorty understood content e.g. by using the video recordings of the tectures. • Students are able to acquire additional knowledge and to recapitulate poorty understood content e.g. by using the video recordings of the Examination of the following dependent Study Time 68, Study Time in Lecture 112 • Examination and scale • Students are able to acquire additional knowledge and to recapitulate poorty understood content e.g. by using the video recordings of the Examination of the Following of Central Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Avirat Systems Engineering Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering	Skills	After passing the module, students are able to:			
Personal Competence Social Competence Social Competence Autonomy • Students are able to discuss technical information in the lecture supported by activating methods. • Students are able to discuss technical information in the lecture supported by activating methods. • Students are able to discuss technical information in the lecture supported by activating methods. • Students are able to independently deepen their acquired knowledge in exercises. • Students are able to acquire additional knowledge and to recapitulate poorty understood content e.g. by using the video recordings of the tectures. • Students are able to acquire additional knowledge and to recapitulate poorty understood content e.g. by using the video recordings of the Examination of the following dependent Study Time 68, Study Time in Lecture 112 • Examination and scale • Students are able to acquire additional knowledge and to recapitulate poorty understood content e.g. by using the video recordings of the Examination of the Following of Central Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Avirat Systems Engineering Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering		a consemplish dimensioning calculations of covered man	phine elements		
Personal Competence Social Competence Social Competence Social Competence - Students are able to discuss technical information in the lecture supported by activating methods. Autonomy - Students are able to discuss technical information in the lecture supported by activating methods. - Students are able to discuss technical information in the lecture supported by activating methods. - Students are able to independently deepen their acquired knowledge in exercises Students are able to independently deepen their acquired knowledge in exercises Students are able to independently deepen their acquired knowledge in exercises Students are able to independently deepen their acquired knowledge in exercises Students are able to independently deepen their acquired knowledge in exercises Students are able to independently deepen their acquired knowledge in exercises Students are able to independently deepen their acquired knowledge in exercises Students are able to independently deepen their acquired knowledge in exercises Students are able to independently deepen their acquired knowledge in exercises Students are acquired and the independently deepen their acquired knowledge in exercises Students are able to independently deepen their acquired knowledge in exercises Students are acquired and the independently deepen their acquired knowledge in exercises Students are acquired and their acquired knowledge in exercises Students are acquired and their acquired knowledge in exercises Students are acquired and their acquired knowledge in exercises Students are acquired and their acquired knowledge in exercises Students are acquired and their acquired acquired and their acquired and their acqu					
Personal Completence Social Competence Social Competence **Students are able to discuss technical information in the lecture supported by activating methods.** **Students are able to independently deepen their acquired knowledge in exercises.** **Students are able to independently deepen their acquired knowledge in exercises.** **Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of tectures.** **Workload in Hours** **More than the following of the program of the progra		· ·			
Personal Competence Social Competence Social Competence Authoromy **Students are able to discuss technical information in the lecture supported by activating methods.* **Students are able to discuss technical information in the lecture supported by activating methods.* **Students are able to discuss technical information in the lecture supported by activating methods.* **Students are able to independently deepen their acquired knowledge in exercises.* **Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of tectures.* **Workload in Hours** **Texamination Minister are able to independently deepen their acquired knowledge in exercises.* **Examination Winiten exam Examination duration and scale **Examination Winiten exam Examination duration and scale **Examination Winiten exam Examination duration and scale **Examination Winiten exam **Examination duration and scale **Examination General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mediatrials in Engineering Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Medianical Engineering Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mediatrials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mecha			matic sketches,		
Students are able to discuss technical information in the lecture supported by activating methods. Autonomy Students are able to independently deepen their acquired knowledge in exercises. Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of the lectures. Workload in Hours Independent Study Time 68, Study Time in Lecture 112 Credit points Examination Written exam Examination Written exam Examination Written exam Examination duration and scale Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (Engiles program): Specialisation Mechanical Engineering, Focus Stempt Systems: Compulsory General Engineering Science (Engilish program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General		evaluate complex designs, technically.			
Students are able to discuss technical information in the lecture supported by activating methods. Autonomy Students are able to independently deepen their acquired knowledge in exercises. Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of the lectures. Workload in Hours Independent Study Time 68, Study Time in Lecture 112 Credit points Examination Written exam Examination Written exam Examination Written exam Examination duration and scale Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (Engiles program): Specialisation Mechanical Engineering, Focus Stempt Systems: Compulsory General Engineering Science (Engilish program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General	Personal Competence				
Sudents are able to discuss technical information in the lecture supported by activating methods. Students are able to independently deepen their acquired knowledge in exercises. Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of telectures. Workload in Hours Independent Study Time 88, Study Time in Lecture 112 Credit points Examination Written exam Examination duration and scale Izo Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Macharian is Engineering. Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechanical Engineering. Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechanical Engineering. Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechanical Engineering. Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechanical Engineering. Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering. Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanicis: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanicis: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Brows Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Mechanical Engineering General Engineering Science (German program): Specialisation Mechanical Engineering, Focus					
Students are able to independently deepen their acquired knowledge in exercises. Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of t lectures. Workload in Hours Examination Exa	30ciai Competence	 Students are able to discuss technical information in t 	he lecture supported by activating methods.		
Students are able to independently deepen their acquired knowledge in exercises. Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of t lectures. Workload in Hours Examination Exa					
Workload in Hours Independent Study Time 68, Study Time in Lecture 112 Credit points Examination Written exam Examination Written exam Examination duration and scale Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Alertal's in Engineering Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Metral to Eventual Engineering Science (German program): Specialisation Mechanical Engineering, Focus Metral to Eventual Engineering Science (German program): Specialisation Mechanical Engineering, Focus Metral to Eventual Engineering Science (German program): Specialisation Mechanical Engineering, Focus Metral to Eventual Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alertal's Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Metral Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Metralis in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Metralis in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Metralis in Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineerin	Autonomy	Students are able to independently deepen their acqu	uired knowledge in exercises.		
Iectures. Independent Study Time in Lecture 112				entea by using the	video recordings of t
Workload in Hours Independent Study Time 68, Study Time in Lecture 112 Credit points Examination Examination duration and scale Examination duration and scale Assignment for the Following Curricula Curricula Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechanicals: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Engry Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineer			and to recognizate poemy understood contr	one org. by doing the	vidoo rooordingo or i
Examination duration and scale Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering; Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (Eng					
Examination duration and scale Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Alterials in Engineering Sciences: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Methatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Methatronics: Compulsory General Engineering Science	Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Ai	Credit points	6			
Assignment for the Following Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft System	Examination	Written exam			
Gurricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Decentalisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechanical Engineering: Compulsory General Engineering Science (Examination duration and scale	120			
Gurricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Decentalisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechanical Engineering: Compulsory General Engineering Science (Assignment for the Following	General Engineering Science (German program): Specialisa:	tion Mechanical Engineering, Focus Energy S	systems: Compulsory	
General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Foc					Compulsory
General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in	Garriodia				
General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Meterials in Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Syst					ices. Compulsory
General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Compulsor General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering,			• •		duction: Compular:
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Eng			• •	·	
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory					
Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Meterials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory				,	0 0 1
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory			ster): Specialisation Mechanical Engineering	g, Focus Materials in	n Engineering Science
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory					
Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory					,
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		General Engineering Science (German program, 7 semeste	er): Specialisation Mechanical Engineering,	Focus Product Deve	lopment and Production
Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		Compulsory			
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		General Engineering Science (German program, 7 semes	ter): Specialisation Mechanical Engineering	Focus Theoretical	Mechanical Engineerii
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		Compulsory			
General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering, Foo	cus Biomechanics: Co	ompulsory
General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering, Foo	cus Energy Systems:	Compulsory
General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Energy S	ystems: Compulsory	
General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		General Engineering Science (English program): Specialisati	ion Mechanical Engineering, Focus Aircraft Sy	stems Engineering:	Compulsory
General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		General Engineering Science (English program): Specialisati	ion Mechanical Engineering, Focus Materials	in Engineering Scien	ices: Compulsory
General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		General Engineering Science (English program): Specialisati	ion Mechanical Engineering, Focus Mechatro	nics: Compulsory	
General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory					duction: Compulsorv
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory					
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory				-	
Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		Solution (Linguist program, / Selliester)		•	
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		General Engineering Science (English program 7			Findingaring Calant
			ter): Specialisation Mechanical Engineering	, Focus Materiais II	n Engineering Science
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production		Compulsory			



Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Mechanical Engineering: Core qualification: Compulsory

Naval Architecture: Core qualification: Compulsory

ourse L0264: Advanced Mechanic	al Engineering Design II	
Тур	Lecture	
Hrs/wk		
CP		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	SoSe	
Content	Advanced Mechanical Engineering Design I & II	
	Lecture	
	Fundamentals of the following machine elements:	
	Linear rolling bearings	
	Axes & shafts	
	Seals	
	Clutches & brakes	
	Belt & chain drives	
	Gear drives	
	Epicyclic gears	
	Crank drives	
	Sliding bearings	
	Elements of fluidics	
	Exercise	
	Calculation methods of the following machine elements:	
	Linear rolling bearings	
	Axes & shafts	
	Clutches & brakes	
	Belt & chain drives	
	Gear drives	
	Epicyclic gears	
	Crank gears	
	Sliding bearings	
	Calculations of hydrostatic systems (fluidics)	
Literature	Debat Tooks back (Sada Markington Onto V. H. Salik and I. (Han) On the all all all all all	
	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Machinenbuch Ford H. W. Warden, G. Goringen, V. A. den all all A. flage.	
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage. Maschinen und Konstruktionselemente: Steinbilder, W. Päner, B. Springer-Verlag, aktuelle Auflage.	
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. 	
	Total and one of Family St., Springs. Forlag, and one Family St.	
	 Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. 	
	 Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage. 	
	Sowie weitere Bücher zu speziellen Themen	

Course L0265: Advanced Mechanical Engineering Design II	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0262: Advanced Mechanic	al Engineering Design I		
	Lecture		
Hrs/wk	2		
CP	· ·		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff		
Language	DE		
Cycle	WiSe		
Content	Advanced Mechanical Engineering Design I & II		
Content	Advanced Mechanical Engineering Design Facility		
	Lecture		
	Fundamentals of the following machine elements:		
	Linear rolling bearings		
	Axes & shafts		
	Seals		
	Clutches & brakes		
	Belt & chain drives		
	Gear drives		
	Epicyclic gears		
	Crank drives		
	Sliding bearings		
	Elements of fluidics		
	Exercise		
	Calculation methods of the following machine elements:		
	 Linear rolling bearings 		
	Axes & shafts		
	Clutches & brakes		
	Belt & chain drives		
	Gear drives		
	Epicyclic gears		
	Crank gears		
	Sliding bearings Calculations of hydrostatic systems (fluidics)		
	- Calculations of Hydrostatic systems (indices)		
Literature			
	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.		
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.		
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.		
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.		
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.		
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.		
	 Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. 		
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.		
	Sowie weitere Bücher zu speziellen Themen		
	The state of the s		

Course L0263: Advanced Mechanical Engineering Design I	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



ourses				
tle		Тур	Hrs/wk	CP
roduction Engineering I (L0608)		Lecture	2	2
roduction Engineering I (L0612)		Recitation Section (large)	1	1
roduction Engineering II (L0610)		Lecture	2	2
roduction Engineering II (L0611)		Recitation Section (large)	1	1
Module Responsible	Prof. Wolfgang Hintze			
Admission Requirements	none			
Recommended Previous	no course assessments required			
Knowledge	to to consider an account of the			
	internship recommended			
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	Students are able to			
	 name basic criteria for the selection of manufacturing p 	processes.		
	 name the main groups of Manufacturing Technology. 			
	 name the application areas of different manufacturing 	processes.		
	 name boundaries, advantages and disadvantages of the 	he different manufacturing process.		
	 describe elements, geometric properties and kinematic 	c variables and requirements for tools, workp	ece and process.	
	 explain the essential models of manufacturing technological 	ogy.		
Skills	Students are able to			
	select manufacturing processes in accordance with the			
	 design manufacturing processes for simple tasks to me 		to be produced.	
	 assess components in terms of their production-oriente 	ed construction.		
Personal Competence				
Social Competence	Students are able to			
	develop solutions in a production environment with qu.	alified personnel at technical level and repre-	cont decisions	
	develop solditoris in a production environment with qui	amed personner at technical level and repre-	sent decisions.	
	0.1.			
Autonomy	Students are able to			
	interpret independently the manufacturing process.			
	 assess own strengths and weaknesses in general. 			
	 assess their learning progress and define gaps to be i 	improved.		
	assess possible consequences of their actions.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
	6			
·	Written exam			
Examination duration and scale	120 min			
	General Engineering Science (German program, 7 semeste	er): Specialisation Mechanical Engineering	Focus Theoretical I	Mechanical Enginee
-	Elective Compulsory			
	General Engineering Science (German program, 7 semeste	er): Specialisation Mechanical Engineering.	Focus Product Deve	lopment and Produc
	Compulsory	, ,		,
	General Engineering Science (English program, 7 semeste	er): Specialisation Mechanical Engineering	Focus Theoretical I	Mechanical Enginee
	Elective Compulsory	5.,. Specialisation Meditalisat Engineening,	. Jour moorewal I	onamoar Engillee
		r). Considiration Machaninal Facing of the	Footo Brodiest Deser	lanmont and Decil
	General Engineering Science (English program, 7 semester	r): Specialisation Mechanical Engineering,	Focus Product Deve	lopment and Produc
	General Engineering Science (English program, 7 semester Compulsory		Focus Product Deve	lopment and Produc
	General Engineering Science (English program, 7 semester		Focus Product Deve	lopment and Produc



Course L0608: Production Engineer	ring I
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Wolfgang Hintze
Language	DE
Cycle	WiSe
Content	 Manufacturing Accuracy Manufacturing Metrology Measurement Errors and Uncertainties Introduction to Forming Massiv forming and Sheet Metal Forming Introduction to Machining Technology Geometrically defined machining (Turning, milling, drilling, broaching, planning)
Literature	Dubbel, Heinrich (Grote, Karl-Heinrich.; Feldhusen, Jörg.; Dietz, Peter.; Ziegmann, Gerhard.;) Taschenbuch für den Maschinenbau : mit Tabellen. Berlin [u.a.] : Springer, 2007 Fritz, Alfred Herbert: Fertigungstechnik : mit 62 Tabellen. Berlin [u.a.] : Springer, 2004 Keferstein, Claus P (Dutschke, Wolfgang.,): Fertigungsmesstechnik : praxisorientierte Grundlagen, moderne Messverfahren. Wiesbaden : Teubner, 2008 Mohr, Richard: Statistik für Ingenieure und Naturwissenschaftler : Grundlagen und Anwendung statistischer Verfahren. Renningen : expert-Verl, 2008 Klocke, F., König, W.: Fertigungsverfahren Bd. 1 Drehen, Fäsen, Bohren. 8. Aufl., Springer (2008) Klocke, Fritz (König, Wilfried.;): Umformen. Berlin [u.a.] : Springer, 2006 Paucksch, E.: Zerspantechnik, Vieweg-Verlag, 1996 Tönshoff, H.K.; Denkena, B., Spanen. Grundlagen, Springer-Verlag (2004)

Course L0612: Production Engineer	ing i
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Wolfgang Hintze
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0610: Production Engineer	ing II
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Wolfgang Hintze, Prof. Claus Emmelmann
Language	DE
Cycle	SoSe
Content	Geometrically undefined machining (grinding, lapping, honing) Introduction into erosion technology Introduction into blastig processes Introduction to the manufacturing process forming (Casting, Powder Metallurgy, Composites) Fundamentals of Laser Technology Process versions and Fundamentals of Laser Joining Technology
Literature	Klocke, F., König, W.: Fertigungsverfahren Bd. 2 Schleifen, Honen, Läppen, 4. Aufl., Springer (2005) Klocke, F., König, W.: Fertigungsverfahren Bd. 3 Abtragen, Generieren und Lasermaterialbearbeitung. 4. Aufl., Springer (2007) Spur, Günter (Stöferle, Theodor.;): Urformen. München [u.a.]: Hanser, 1981 Schatt, Werner (Wieters, Klaus-Peter,; Kieback, Bernd,;): Pulvermetallurgie: Technologien und Werkstoffe. Berlin [u.a.]: Springer, 2007



Course L0611: Production Engineering II	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Wolfgang Hintze, Prof. Claus Emmelmann
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0596: Advanced	Mechanical Design Project
Courses	
Title	Typ Hrs/wk CP
Advanced Mechanical Design Project (L02	~
Module Responsible	Prof. Dieter Krause
Admission Requirements	None
Recommended Previous	
Knowledge	Mechanical Engineering: Design
	Advanced Mechanical Engineering Design
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After passing the module, students are able to:
	express the procedure for systematically handling of
	complex design tasks ,
	describe working principles, their use and combination possibilities,
	explain guidelines for designing for function and manufacturing,
	explain advanced use-oriented knowledge of machine elements.
01.11	
Skills	After passing the module, students are able to:
	 analyze complex tasks and develop principle solutions using sketches,
	convert principle solutions into a detailed design,
	 use methods to design and solve engineering design tasks systematically and solution-oriented,
	 create a technical documentation including all necessary technical drawings to understand the functions of the system,
	document calculations of selected machine elements clearly and in detail.
Personal Competence	
	After passing the module, students are able to:
	present and discuss solutions and technical drawings within groups,
	reflect the own results in the work groups of the course
Autonomy	After passing the module, students are able to:
	 independently solve complex design projects, while motivating themselves, acquiring necessary knowledge and selecting appropriate method to independently solve problems.
	to independently solve problems.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Examination	Written exam
Examination duration and scale	180
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Curricula	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulso
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product
	Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineeri
	Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulso
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product
	Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering
	Compulsory
	Mechanical Engineering: Core qualification: Compulsory



Course L0266: Advanced Mechanical Design Project			
Тур	Practical Course		
Hrs/wk	4		
CP	6		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff, Dr. Jens Schmidt, Dr. Volkert Wollesen		
Language	DE		
Cycle	WiSe		
Content	Das Konstruktionsprojekt gliedert sich in den Entwurf eines Getriebes sowie die Lösungsfindung.		
	Getriebekonstruktion in Einzelarbeit		
	Erarbeitung von Lösungsprinzipien		
	Berechnung von Maschinenelementen		
	Entwurf eines Getriebes im Hauptschnitt plus allen Außenansichten		
	Erstellung einer ausführlichen Dokumentation		
	Lösungsfindung		
	 Methodische Erarbeitung von prinzipiellen Lösungskonzepten 		
	Erstellen einer Dokumentation		
Literature	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.		
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.		
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. 		
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.		
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.		
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.		
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.		
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.		
	Sowie weitere Bücher zu speziellen Themen		



Module M0726: Production	Technology			
Courses				
Title		Тур	Hrs/wk	СР
Fundamentals of Machine Tools (L0689)		Lecture	3	3
Forming and Cutting Technology (L0613)		Lecture	2	2
Forming and Cutting Technology (L0614)		Recitation Section (large)	1	1
Module Responsible	Prof. Wolfgang Hintze			
Admission Requirements	None			
Recommended Previous	without major course assessment			
Knowledge				
	internship recommended			
	Previous knowledge in mathematics, mechanics and electrical	engineering		
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge				
	and his the beside of able formation and and			
	explain the basics of chip formation and mechanisms a			
	explain methods and parameters for design and analys			
	explain technical concepts of machine tool building and applaint transport contractions and functions of CNC machines.	•	•	
	explain types, constructions and functions of CNC-mac	nines and give an overview on multi-machi	ne systems.	
	explain equipment components.			
Skills	Students are able to			
	 select tool geometry, cutting materials, process parame 	ters and appropriate measuring technique	in accordance with the	requirements.
	estimate occurring forces and temperatures during chip	formation.		
	select appropriate machine tools for machining and cre	ate NC programs for turning and milling.		
	assess the quality of a machine tools and to detect wea	k points.		
Personal Competence				
Social Competence	Students are able to			
	develop solutions in a production environment with qua	llified personnel at technical level and repr	esent decisions.	
Autonomy	Students are able to			
	interpret independently cutting processes.			
	create independently NC programs.			
	select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independently machine tools by reference to approximate the select independent	propriate requirements		
	assess own strengths and weaknesses in general.			
	assess their learning progress and define gaps to be in	nproved.		
	assess possible consequences of their actions.	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min		<u> </u>	
Assignment for the Following	General Engineering Science (German program): Specialisation	on Mechanical Engineering, Focus Product	Development and Pro	duction: Compulsory
Curricula				
	Compulsory			
	General Engineering Science (English program): Specialisatio	n Mechanical Engineering, Focus Product	Development and Prod	duction: Compulsory
	General Engineering Science (English program, 7 semester	: Specialisation Mechanical Engineering	, Focus Product Devel	opment and Product
	Compulsory			
	Mechanical Engineering: Specialisation Product Development	and Production: Compulsory		
	Product Development, Materials and Production: Technical Co	mplementary Course Core Studies: Electiv	re Compulsory	



Course L0689: Fundamentals of Machine Tools			
Typ Lecture			
Hrs/wk	3		
СР	3		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42		
Lecturer	Prof. Thorsten Schüppstuhl		
Language	DE		
Cycle	WiSe		
Content	Terminology and trends in machine tool building		
	CNC controls		
	NC programming and NC programming systems		
	Types, construction and function of CNC machines		
	Multi-machinesystems		
	Equipmentcomponents for machine tools		
	Assessment of machine tools		
Literature	Conrad, K.J		
	Taschenbuch der Werkzeugmaschinen		
	9783446406414		
	Fachbuchverlag 2006		
	Perović, Božina		
	Spanende Werkzeugmaschinen - Ausführungsformen und Vergleichstabellen		
	ISBN: 3540899529		
	Berlin [u.a.]: Springer, 2009		
	Weck, Manfred		
	Werkzeugmaschinen 1 - Maschinenarten und Anwendungsbereiche		
	ISBN: 9783540225041		
	Berlin [u.a.]: Springer, 2005		
	Weck, Manfred; Brecher, Christian		
	Werkzeugmaschinen 4 - Automatisierung von Maschinen und Anlagen ISBN: 3540225072		
	Berlin [u.a.]: Springer, 2006		
	Weck, Manfred; Brecher, Christian		
	Werkzeugmaschinen 5 - Messtechnische Untersuchung und Beurteilung, dynamische Stabilität		
	ISBN: 3540225056		
	Berlin [u.a.]: Springer, 2006		
	L .		



Course L0613: Forming and Cutting	Technology
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Wolfgang Hintze
Language	DE
Cycle	WiSe
Content	Thermomechanical Principles and Models of Machining Chip Formation, Forces, Temperature and Tribology process Wear mechanisms and wear patterns Machinability by Cutting and Forming, Specific Problems of Light Weight Structures Cutting Material and Coatings Methods and Parameters for Analysis and Configuration of Forming and Cutting Processes and Tools
Literature	Lange, K.; Umformtechnik Grundlagen, 2. Auflage, Springer (2002) Tönshoff, H.; Spanen Grundlagen, 2. Auflage, Springer Verlag (2004) König, W., Klocke, F.; Fertigungsverfahren Bd. 4 Massivumformung, 4. Auflage, VDI-Verlag (1996) König, W., Klocke, F.; Fertigungsverfahren Bd. 5 Blechbearbeitung, 3. Auflage, VDI-Verlag (1995) Klocke, F., König, W.; Fertigungsverfahren Schleifen, Honen, Läppen, 4. Auflage, Springer Verlag (2005) König, W., Klocke, F.: Fertigungsverfahren Drehen, Fräsen, Bohren, 7. Auflage, Springer Verlag (2002)

Course L0614: Forming and Cutting Technology	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Wolfgang Hintze
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



	Engineering	
Courses		
Title	Typ Hrs/wl	k CP
Computer Engineering (L0321)	Lecture 3	4
Computer Engineering (L0324)	Recitation Section (small) 1	2
Module Responsible	Prof. Heiko Falk	
Admission Requirements	s None	
Recommended Previous	Basic knowledge in electrical engineering	
Knowledge	The successful completion of the labs will be honored during the evaluation of the module's examination according to the	following rules:
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the	successful labs, such th
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.	
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge	This module deals with the foundations of the functionality of computing systems. It covers the layers from the assemb	bly-level programming do
	gates. The module includes the following topics:	
	Introduction Country in the control of the Country in the	
	 Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks Sequential logic: Flip-flops, automata, systematic hardware design 	
	Technological foundations	
	Computer arithmetic: Integer addition, subtraction, multiplication and division	
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining	
	Memories: Memory hierarchies, SRAM, DRAM, caches	
	 Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses 	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure an	
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a	
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing sy	ystems - from gates and c
	up to complete processors.	
	After successful completion of the module, the students are able to judge the interdependencies between a physical con	mputer system and the so
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware	e-centric abstraction layer
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction le	vels have on an entire sys
	performance and to propose feasible options.	
Personal Competence		
Social Competence		
30ciai Competence	5 Students are able to solve similar problems alone or in a group and to present the results accordingly.	
Autonomy	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Credit points		
Examination		
Examination duration and scale		
Assignment for the Following Curricula		
Curricula	a General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Com	npulsory
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronic	cs: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanic	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Syst	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mater	rials in Engineering Scie
	Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theore	etical Mechanical Engine
	Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product	t Development and Produ
	Compulsory	
	Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syst	tems: Compulsory
		tems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syst	etems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System Computer Science: Core qualification: Compulsory	stems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syst Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory	stems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syst Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	stems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syst Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory	stems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syst Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory	stems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syst Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory	stems: Compulsory

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

General Engineering Science and Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering		
Тур	cture	
Hrs/wk		
CP		
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Heiko Falk	
Language	DE	
Cycle	WiSe	
Content	Introduction Combinational Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output	
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005. 	

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



ntroduction to Control Systems (L0654) htroduction to Control Systems (L0655) Module Responsible		
mtroduction to Control Systems (L0655) Module Responsible	Typ Hrs/wk	CP
Module Responsible	Lecture 2 Recitation Section (small) 2	4 2
-		2
Admission Requirements	Prof. Herbert Werner	
	none	
	Representation of signals and systems in time and frequency domain, Laplace transform	
Knowledge		
-	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain proper	rties of first and second or
	systems	
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency respon	se and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.	
	They can explain the role of the phase margin in analysis and synthesis of control loops	
	 They can explain the way a PID controller affects a control loop in terms of its frequency response 	
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally	
Chille		
Skills	Students can transform models of linear dynamic systems from time to frequency domain and vice versa	
	They can simulate and assess the behavior of systems and control loops	
	 They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules 	
	They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques	5
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital imple	ementation
	 They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks 	
Personal Competence		
·	Students can work in small groups to jointly solve technical problems, and experimentally validate their controller designs	
•	Students can obtain information from provided sources (lecture notes, software documentation, experiment guides) and	d uso it whon solving giv
*	problems.	u use it when solving giv
	problems.	
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.	
Wouldood in House	Independent Charle Time 404 Charle Time in Leature FC	
	Independent Study Time 124, Study Time in Lecture 56	
•	6	
	Written exam	
	120 min	
	General Engineering Science (German program): Core qualification: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	I
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compu	iisory
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	Commula
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics:	Compulsory
	Constal Engineering Colones (Cormon program 7	Compule
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System	ns Engineering: Compulso
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material	ns Engineering: Compulso
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory	ns Engineering: Compulso Is in Engineering Scienc
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic	ns Engineering: Compulso Is in Engineering Scienc
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineeri
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product December 1 Specialisation Mechanical Engineering, Focus Product December 2 Specialisation Mecha	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineeri
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product De Compulsory	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineering evelopment and Production
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product De Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineering evelopment and Production
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Dictional Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System Bioprocess Engineering: Core qualification: Compulsory	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineering evelopment and Production
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product De Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineering evelopment and Production
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Decompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineering evelopment and Production
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Decompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineering evelopment and Production
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Decompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineering evelopment and Production
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Decompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineering evelopment and Production
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Decompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	ns Engineering: Compulso Is in Engineering Science al Mechanical Engineeri evelopment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Decompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineering evelopment and Production
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Decompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineering evelopment and Production
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft System General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Decompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	ns Engineering: Compulso Is in Engineering Scienc cal Mechanical Engineering evelopment and Production



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

Тур	Lecture	
Hrs/wk	2	
СР	4	
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28	
Lecturer	Prof. Herbert Werner	
Language	DE	
Cycle	WiSe	
Content	Signals and systems	
	Linear systems, differential equations and transfer functions	
	First and second order systems, poles and zeros, impulse and step response	
	Stability	
	Feedback systems	
	Principle of feedback, open-loop versus closed-loop control	
	Reference tracking and disturbance rejection	
	Types of feedback, PID control	
	System type and steady-state error, error constants	
	Internal model principle	
	Root locus techniques	
	Root locus plots	
	Root locus design of PID controllers	
	Frequency response techniques	
	Bode diagram	
	Minimum and non-minimum phase systems	
	Nyquist plot, Nyquist stability criterion, phase and gain margin	
	Loop shaping, lead lag compensation	
	Frequency response interpretation of PID control	
	Time delay systems	
	Root locus and frequency response of time delay systems	
	Smith predictor	
	Digital control	
	Sampled-data systems, difference equations	
	Tustin approximation, digital implementation of PID controllers	
	Software tools	
	Introduction to Matlab, Simulink, Control toolbox	
	Computer-based exercises throughout the course	
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"	
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009	
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010	
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010	



Course L0655: Introduction to Control Systems	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Typ Hrs/wk CP AE-Team Project (L0271) Problem-based Learning 2 2 everlopment of Lightweight Design Products (L0270) Lecture 2 2	Module M0599: Integrated I	Product Development and Lightweight Design			
The Access Project (A277) Advanced Project (A277) Access Project (Courses				
Module Responsible Prof. Dieter Knusse None	Title CAE-Team Project (L0271) Development of Lightweight Design Produ	cts (L0270)	Problem-based Learning	2	2
Admission Requirements Advanced Knowledge about engineering design Knowledge Knowledge Advanced Knowledge about engineering design Mechanical Engineering Design Advanced Mechanical Engineering Design	Integrated Product Development I (L0269)		Lecture	2	2
Recommended Previous Knowledge Fundamentals of Mechanical Engineering Design Mechanical Engineering Design Advanced Mechanical Engineering Design Development and Production Computory Ceneral Engineering Science (Engilsh program.) Specialisation Mechanical Engineering, Foous Androat Systems Engineering Computory Ceneral Engineering Science (Engilsh program.) Specialisation Mechanical Engineering, Foous Androat Systems Engineering Computory Ceneral Engineering Science (Engilsh program.) Specialisation Mechanical Engineering, Foous Androat Systems Engineering Computory Ceneral Engineering Science (Engilsh program.) Specialisation Mechanical Engineering, Foous Androat Systems Engineering Computory Ceneral Engineering Science (Engilsh program.) Specialisation Mechanical Engineering, Foous Androat Systems Engineering Computory Ceneral Engineering Science (Engilsh program.) Specialisation Mechanical Engineeri	Module Responsible	Prof. Dieter Krause			
Knowledge Rudamentals of Mechanical Engineering Design Advanced Mechanical Engineering Design Advanced Mechanical Engineering Design Advanced Mechanical Engineering Design Advanced Mechanical Engineering Design Professional Competence Rnowledge Rnowledge After completing the module, students are capable of: - explaining the functional principle of 3D-CAD-Systems, PDM- and FEM-Systems - describing the interaction of the different CAE-Systems in the product development process Skills After completing the module, students are able to: - evaluate different CAD- and PDM-Systems with regards to the desired requirements such as classification schemes and product structuring - design an exemplary product using CAD-PDM- and/or FEM-Systems with shared workload Personal Competence Social Competence Social Competence After completing the module, students are able to: - To develop a project plan and allocate work appropriate work packages in the framework of group discussions - Prevent project results as a team for instance in a presentation Students are capable of: - Independently adapt to a CAE-Tool and complete a given practical task with it Workload in Hours Morthodad in Hours Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering; Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering; Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering; Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering; Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering; Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering; Compulsory G	Admission Requirements	None			
Fundamentates of Mechanical Engineering Design Mechanical Engineering: Design Advanced Mechanical Engineering Design Advanced Mechanical Engineering Design Alter taking part successfully, students have reached the following fearning results Professional Competence Knowledge After completing the module, students are capable of: explaining the functional principle of SD-CAD-Systems, PDM- and FEM-Systems describing the interaction of the different CAE-Systems in the product development process Skills After completing the module, students are able to: evaluate different CAD- and PDM-Systems with regards to the desired requirements such as classification schemes and product structuring design an exemplary product using CAD-PDM- and FEM-Systems with shared workload Personal Competence Social Competence Social Competence After completing the module, students are able to: To develop a project results as a learn for instance in a presentation Autonomy Students are capable of: independently adapt to a CAE-Tool and complete a given practical task with it Workload in flows: Independently adapt to a CAE-Tool and complete a given practical task with it Workload in flows: General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (Eng	Recommended Previous	Advanced Knowledge about engineering design:			
Educational Objectives Professional Competence Knowledge After completing the module, students have reached the following learning results Professional Competence Knowledge After completing the module, students are capable of: • explaining the functional principle of 3D-CAD-Systems, PDM- and FEM-Systems • describing the interaction of the different CAE-Systems in the product development process Skills After completing the module, students are able to: • evaluate different CAD- and PDM-Systems with regards to the desired requirements such as classification schemes and product structuring • design an exemplary product using CAD-PDM- and/or FEM-Systems with shared workload Personal Competence Social Competence Social Competence After completing the module, students are able to: • To develop a project plan and allocate work appropriate work packages in the framework of group discussions • Present project results as a team for instance in a presentiation Autonomy Students are capable of: • Independently adapt to a CAE-Tool and complete a given practical task with it. Workload in Hours Workload in Hours (Written exam Examination Written exam Curricus General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (Engli	Knowledge	Fundamentals of Mechanical Engineering Design			
Professional Competence Knowledge After completing the module, students are capable of: explaining the functional principle of 3D CAD-Systems, PDM- and FEM-Systems describing the interaction of the different CAE-Systems in the product development process Skills After completing the module, students are able to: evaluate different CAD- and PDM-Systems with regards to the desired requirements such as classification schemes and product structuring design an exemplary product using CAD-PDM- and/or FEM-Systems with shared workload Personal Competence Social Competence Authoromy To develop a project plan and allocate work appropriate work packages in the framework of group discussions Present project results as a team for instance in a presentation Authoromy Students are capable of: independently adapt to a CAE-Tool and complete a given practical task with it Workload in Hours Credit points To diveled a Magendent Study Time 96, Study Time in Lecture 84 Credit points Curricula Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Special		Mechanical Engineering: Design			
Professional Competence Knowledge After completing the functional principle of 3D-CAD-Systems, PDM- and FEM-Systems		Advanced Mechanical Engineering Design			
After completing the module, students are capable of: explaining the functional principle of 3D-CAD-Systems, PDM- and FEM-Systems describing the interaction of the different CAE-Systems in the product development process After completing the module, students are able to: evaluate different CAD- and PDM-Systems with regards to the desired requirements such as classification schemes and product structuring design an exemplary product using CAD-PDM- and/or FEM-Systems with shared workload Personal Competence Social Competence Social Competence After completing the module, students are able to: To develop a project plan and allocate work appropriate work packages in the framework of group discussions Present project results as a team for instance in a presentation Students are capable of: independently adapt to a CAE-Tool and complete a given practical task with it Workload in Hours Credit points Examination Written exam Assignment for the Following Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Produ	Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
explaining the functional principle of 3D-CAD-Systems, PDM- and FEM-Systems describing the interaction of the different CAE-Systems in the product development process After completing the module, students are able to: evaluate different CAD- and PDM-Systems with regards to the desired requirements such as classification schemes and product structuring design an exemplary product using CAD-PDM- andor FEM-Systems with shared workload Personal Completence Social Competence Alter completing the module, students are able to:	•	· · · · · · · · · · · · · · · · · · ·			
After completing the module, students are able to: evaluate different CAD- and PDM-Systems with regards to the desired requirements such as classification schemes and product structuring design an exemplary product using CAD-PDM- and/or FEM-Systems with shared workload Personal Competence Social Competence After completing the module, students are able to: To develop a project plan and allocate work appropriate work packages in the framework of group discussions Present project results as a team for instance in a presentation Students are capable of: independently adapt to a CAE-Tool and complete a given practical task with it Workload in Hours Independent Study Time 96, Study Time in Lecture 84 Credit points Examination Wiffen exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory Gener	Knowledge	After completing the module, students are capable of:			
After completing the module, students are able to: • evaluate different CAD- and PDM-Systems with regards to the desired requirements such as classification schemes and product structuring • design an exemplary product using CAD-,PDM- and/or FEM-Systems with shared workload Personal Competence Social Competence After completing the module, students are able to: • To develop a project plan and allocate work appropriate work packages in the framework of group discussions • Present project results as a team for instance in a presentation Autonomy Students are capable of: • independently adapt to a CAE-Tool and complete a given practical task with it Workload in Hours Independently adapt to a CAE-Tool and complete a given practical task with it Workload in Hours Assignment for the Following Curricula Assignment for the Following Curricula Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering: Specialisation Production: Compulsory Mechanical Engineering: Specialisation Production: Compulsory Mechanical Engineering: Specialisation Production: Co					
evaluate different CAD- and PDM-Systems with regards to the desired requirements such as classification schemes and product structuring design an exemplary product using CAD-,PDM- and/or FEM-Systems with shared workdoad Personal Competence Social Competence After completing the module, students are able to:	Skills				
Personal Competence Social Competence After completing the module, students are able to: • To develop a project plan and allocate work appropriate work packages in the framework of group discussions • Present project results as a team for instance in a presentation Autonomy Students are capable of: • independently adapt to a CAE-Tool and complete a given practical task with it Workload in Hours Credit points 6 Examination Written exam Examination duration and scale Our ricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory		After completing the module, students are able to:			
Autonomy Autonomy Students are capable of: independently adapt to a CAE-Tool and complete a given practical task with it Workload in Hours Independently adapt to a CAE-Tool and complete a given practical task with it Workload in Hours Independent Study Time 96, Study Time in Lecture 84 Credit points Examination Examination Written exam Examination duration and scale Ourricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory				cation schemes and	product structuring
Present project results as a team for instance in a presentation Autonomy Students are capable of: independently adapt to a CAE-Tool and complete a given practical task with it Workload in Hours Independent Study Time 96, Study Time in Lecture 84 Credit points Examination Written exam Examination duration and scale General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory	•	After completing the module, students are able to:			
Workload in Hours Independent Study Time 96, Study Time in Lecture 84 Credit points 6 Examination Written exam Examination duration and scale 90 Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory				discussions	
Workload in Hours Credit points 6 Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory	Autonomy	Students are capable of:			
Credit points 6 Examination Written exam Examination duration and scale 90 Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory		independently adapt to a CAE-Tool and complete a given	n practical task with it		
Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory	Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering: Specialisation Product Development and Production: Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory	Credit points	6			
Assignment for the Following Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory	Examination	Written exam			
General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory					
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productio Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productio Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory					
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory	Curricula		* *	•	
Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productio Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory				•	
General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productio Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory			Spoorandaron moonamear Engineering,		opmont and Froddon
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor, General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productio Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory			Mechanical Engineering, Focus Aircraft Sy	stems Engineering: C	Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory					
Compulsory Mechanical Engineering: Specialisation Product Development and Production: Compulsory		General Engineering Science (English program, 7 semester): Sp	pecialisation Mechanical Engineering, Focu	ıs Aircraft Systems Er	gineering: Compulsory
Mechanical Engineering: Specialisation Product Development and Production: Compulsory			Specialisation Mechanical Engineering, F	Focus Product Devel	opment and Production
			nd Braduation: Compulation		
0 0 0					
Product Development, Materials and Production: Technical Complementary Course Core Studies: Elective Compulsory				Compulsory	



Course L0271: CAE-Team Project	
Тур	Problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause
Language	DE
Cycle	SoSe
Content	 Practical Introduction in the used software systems (Creo, Windchill, Hyperworks) Team formation, allocation of tasks and generation of a project plan Collective creation of one product out of CAD models supported by FEM calculations and PDM system Manufacturing of selected parts using 3D printer Presentation of results Description Part of the module is a project based team orientated practical course using the PBL method. In this course, students learn the handling of modern CAD, PDM and FEM systems (Creo, Windchill and Hyperworks). After a short introduction in the applied software systems, students work in teams on a task during the semester. The aim is the development of one product out of several CAD parts models using a PDM system including FEM calculations of selected parts and 3D printing of parts. The developed product must be presented in a joint presentation.
Literature	-

Course L0270: Development of Ligh	ntweight Design Products		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Dieter Krause		
Language	DE		
Cycle	SoSe		
Content	Lightweight design materials Product development process for lightweight structures Dimensioning of lightweight structures		
Literature	 Schürmann, H., "Konstruieren mit Faser-Kunststoff-Verbunden", Springer, Berlin, 2005. Klein, B., "Leichtbau-Konstruktion", Vieweg & Sohn, Braunschweig, 1989. Krause, D., "Leichtbau", In: Handbuch Konstruktion, Hrsg.: Rieg, F., Steinhilper, R., München, Carl Hanser Verlag, 2012. Schulte, K., Fiedler, B., "Structure and Properties of Composite Materials", Hamburg, TUHH - TuTech Innovation GmbH, 2005. Wiedemann, J., "Leichtbau Band 1: Elemente", Springer, Berlin, Heidelberg, 1986. 		

Course L0269: Integrated Product Development I			
Тур	Lecture		
Hrs/wk	2		
CP			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Dieter Krause		
Language	DE		
Cycle	SoSe		
Content	Introduction to Integrated Product Development 3D CAD -Systems and CAD interfaces Administration of part lists / PDM systems PDM in different industries Selection of CAD-/PDM Systems Simulation Construction methods Design for X		
Literature	 Ehrlenspiel, K.: Integrierte Produktentwicklung, München, Carl Hanser Verlag Lee, K.: Principles of CAD / CAM / CAE Systems, Addison Wesles Schichtel, M.: Produktdatenmodellierung in der Praxis, München, Carl Hanser Verlag Anderl, R.: CAD Schnittstellen, München, Carl Hanser Verlag Spur, G., Krause, F.: Das virtuelle Produkt, München, Carl Hanser Verlag 		



Module M1005: Enhanced I	Fundamentals of Materials Science			
Courses				
Fitle		Tun	Hrs/wk	CP
	Johnman (11999)	Typ Lecture	2	2
Enhanced Fundamentals: Ceramics and F Enhanced Fundamentals: Ceramics and F		Recitation Section (large)	1	1
Enhanced Fundamentals: Metals (L1086)	olyfilets (E1234)	Lecture	2	3
	Prof. Gerold Schneider		_	
Admission Requirements	None			
Recommended Previous	Module "Fundamentals of Materials Science"			
Knowledge				
	Module "Materials Science Laboratory"			
	Module "Advanced Materials"			
	Module Advanced Materials			
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	The students are able to give an enhanced overview over the follo	owing topics		
	in metals, polymers and ceramics: Atomic bonds, crystal and ar	norphous structures, defects, electrical	and mass transport, n	nicrostructure and pha
	diagrams. They are capable to explain the corresponding technic	al terms.		
Skills	The students are able to apply the appropriate physical and chem	nical methods for the above mentioned	subjects.	
			,	
Personal Competence				
Social Competence				
Autonomy	The students are capable to understand independently the structure	cture and propeties of ceramics, metals	and polymers. They s	should be able to crita
	evaluate the profoundness of their knowledge.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Materia	ls in Engineering Scier	ces: Compulsory
Curricula	General Engineering Science (German program, 7 semester):	: Specialisation Mechanical Engineering	ng, Focus Materials in	Engineering Science
	Compulsory	J		
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering	, Focus Product Devel	opment and Producti
	Compulsory			
	General Engineering Science (English program): Specialisation N	Mechanical Engineering, Focus Material	s in Engineering Scien	ces: Compulsory
	General Engineering Science (English program, 7 semester):			
	Compulsory			
	General Engineering Science (English program, 7 semester): 9	Specialisation Mechanical Engineering	, Focus Product Devel	onment and Product
				opinent and i roducti
	Compulsory			opinent and i roducii
	Compulsory Mechanical Engineering: Specialisation Materials in Engineering			opment and Froducti
	•	Sciences: Compulsory		opinent and Froducti



Course L1233: Enhanced Fundamen	
Typ	Lecture
Hrs/wk	
CP Workload in Hours	2 Independent Study Time 22 Study Time in Lecture 22
Lecturer	Independent Study Time 32, Study Time in Lecture 28 Prof. Gerold Schneider, Prof. Bodo Fiedler
Language	DE/EN
Cycle	SoSe
Content	1. Einführung
	Natürliche "Keramiken" - Steine
	"Künstliche" Keramik - vom Porzellan bis zur Hochleistungskeramik Anwendungen von Hochleistungskeramik
	2. Pulverherstellung
	Einteilung der Pulversyntheseverfahren
	Der Bayer-Prozess zur Al2O3-Herstellung
	Der Acheson-Prozess zur SiC-Herstellung
	Chemical Vapour Deposition
	Pulveraufbereitung
	Mahltechnik
	Sprühtrockner
	3. Formgebung
	Arten der Formgebung
	Pressen (0 - 15 % Feuchte)
	Gießen (> 25 % Feuchte)
	Plastische Formgebung (15 - 25 % Feuchte)
	4. Sintern
	4. Silletti
	Triebkraft des Sinterns
	Effekt von gekrümmten Oberflächen und Diffusionswegen
	Sinterstadien des isothermen Festphasensinterns
	Herring scaling laws Heißisostatisches Pressen
	11615303(4130116311633611
	5. Mechanische Eigenschaften von Keramiken
	Elastisches und plastisches Materialverhalten
	Bruchzähigkeit - Linear-elastische Bruchmechanik
	Festigkeit - Festigkeitsstreuung
	6. Elektrische Eigenschaften von Keramiken
	Ferroelektische Keramiken
	Piezo-, ferroelektrische Materialeigenschaften
	Anwendungen
	Keramische Ionenleiter
	Ionische Leitfähigkeit
	Dotiertes Zirkonoxid in der Brennstoffzelle und Lambdasonde
Literature	D R H Jones, Michael F. Ashby, Engineering Materials 1, An Introduction to Properties, Applications and Design, Elesevier
	D.W. Richerson, Modern Ceramic Engineering, Marcel Decker, New York, 1992
	W.D. Kingery, Introduction to Ceramics, John Wiley & Sons, New York, 1975
	D.J. Green, An introduction to the mechanical properties of ceramics", Cambridge University Press, 1998
	D. Munz, T. Fett, Ceramics, Springer, 2001
	Polymerwerkstoffe
	Struktur und mechanische Eigenschaften G.W.Ehrenstein;
	Hanser Verlag; ISBN 3-446-12478-0; ca. 20 €
	Kunststoffphysik
	W.Retting, H.M.Laun; Hanser Verlag; ISBN 3446162356; ca. 25 €
	Werkstoffkunde Kunststoffe
	G.Menges; Hanser Verlag; ISBN 3-446-15612-7; ca. 25 €
	Kunststoff-Kompendium
	A.Frank, K. Biederbick; Vogel Buchverlag; ISBN 3-8023-0135-8; ca.30 €



ourse L1234: Enhanced Fundamentals: Ceramics and Polymers	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Gerold Schneider, Prof. Bodo Fiedler
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1086: Enhanced Fundamentals: Metals	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Jörg Weißmüller, Prof. Patrick Huber
Language	DE
Cycle	SoSe
Content	Enhanced Fundamentals of Metals:
	Introduction to phenomenological thermodynamics
	Elasticity
	Thermal materials behavior (heat capacity, thermal expansion)
	Conductors, semiconductors, isolators: conduction mechanisms and band structure
	Superconductors
	Dry corrosion
	Electrochemistry in the material sciences
	Wet corrosion
	Alloy corrosion
	Corrosion protection
	Stainless steel
	Battery materials
	Supercapacitors
	Fuel cells
	Materials for hydrogen storage Magnetism physican appropriate at a mission missage at a
	 Magnetism: phenomenology, Magnetometers, atomistics, micromagnetism Magnetic materials
	Magnetic materials: applications
	magnoso matorialo appriodisorio
Literature	Vorlesungsskript



Courses				
Title		Тур	Hrs/wk	CP
ntroduction to Management (L0880)		Lecture	3	3
Project Entrepreneurship (L0882)		Problem-based Learning	2	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge	After taking part successfully, students have reached the follow	na loarning regulte		
Educational Objectives	After taking part successfully, students have reached the follow	ng learning results		
Professional Competence Knowledge	After taking this module, students know the important basics of	many different areas in Rusiness and Ma	nagement from Plan	ning and Organication
Mioweage	Marketing and Innovation, and also to Investment and Controlli		nagement, nom i ian	ing and Organisation
	explain the differences between Economics and Manage	ement and the sub-disciplines in Managem	ent and to name impo	ortant definitions from t
	field of Management			
	explain the most important aspects of and goals in Man			•
	describe and explain basic business functions as prod		chain management,	organization and hum
	ressource management, information management, inno		Itiple objectives and	uncortainty and oval
	 explain the relevance of planning and decision makin some basic methods from mathematical Finance 	g in business, esp. in situations under mu	nuple objectives and	uncertainty, and expir
	state basics from accounting and costing and selected of	ontrolling methods.		
	state successful accounting and cooling and corolled			
Skills	Students are able to analyse business units with respect Entrepreneurship project in a team. In particular, they are able	, ,	ctives, strategies etc) and to carry out
	 analyse Management goals and structure them appropring 	ately		
	analyse organisational and staff structures of companie			
	apply methods for decision making under multiple objection.			
	analyse production and procurement systems and Busing			
	analyse and apply basic methods of marketing	•		
	select and apply basic methods from mathematical final	ce to predefined problems		
	 apply basic methods from accounting, costing and contri 	olling to predefined problems		
Personal Competence				
Social Competence	Students are able to			
30ciai Competence	Students are able to			
	 work successfully in a team of students 			
	 to apply their knowledge from the lecture to an entrepre 	neurship project and write a coherent report	on the project	
	 to communicate appropriately and 			
	 to cooperate respectfully with their fellow students. 			
Autonomy	Students are able to			
	 work in a team and to organize the team themselves 			
	 to write a report on their project. 			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
	6			
Credit points				
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation	, , ,	omnulsory	
	General Engineering Science (German program): Specialisation	**		
	General Engineering Science (German program): Specialisation		paicery	
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester):	specialisation Electrical Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester):	specialisation Process Engineering: Compu	llsory	
	General Engineering Science (German program, 7 semester):	pecialisation Biomedical Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semester):	specialisation Naval Architecture: Compulso	ory	
	General Engineering Science (German program, 7 semester):	specialisation Computer Science: Compulso	ory	
	General Engineering Science (German program, 7 semester):	Specialisation Bioprocess Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semester):	specialisation Civil Engineering: Compulsor	у	
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):		-	
	Constal Engineering Colones (Courses arranges 7 constal	N: Cassialization Machanical Engineering	. Fasca Materials in	Fasings de Calana
	General Engineering Science (German program, 7 semeste	n). Specialisation Mechanical Engineering	, Focus Maleriais ir	Engineering Science
	Compulsory			



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

ompulsory

 $General\ Engineering\ Science\ (German\ program, 7\ semester): Specialisation\ Mechanical\ Engineering, Focus\ Energy\ Systems: Compulsory$

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program); Specialisation Energy and Environmental Engineering; Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester); Specialisation Computer Science; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Compulsory\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Mechanical\ Engineering,\ M$

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 $\label{thm:mechanical engineering:Core qualification:Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Lecturer Prof. C Kerstel Language DE Cycle WiSe/S Content	endent Study Time 48, Study Time in Lecture 42 Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgangen, Prof. Matthias Meyer, Prof. Thomas Wrona SoSe Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing
CP 3 Workload in Hours Indepe Lecturer Prof. C Kerstel Language DE Cycle WiSe/S Content	Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgan n, Prof. Matthias Meyer, Prof. Thomas Wrona SoSe Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing
Workload in Hours Indepe Lecturer Prof. C Kerstei Language DE Cycle Content	Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgan n, Prof. Matthias Meyer, Prof. Thomas Wrona SoSe Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing
Lecturer Prof. C Kerstei Language DE Cycle WiSe/S Content	Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgan n, Prof. Matthias Meyer, Prof. Thomas Wrona SoSe Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing
Language DE Cycle WiSe/S Content	Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing
Language DE Cycle WiSe/S Content	Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing
Cycle WiSe/S Content Content	Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing
Content	Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing
	Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing
	different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions
	Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects erg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
Literature Dambe	ary, 4., Authorition, 2 Demonstrational ministration of the Authorition (14. Authorition 2000)
Eisenfü	ühr, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
Heinho	old, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
Krusch	witz, L.: Finanzmathematik. 3. Auflage, München 2001.
Pellens	s, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
Schwe	eitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
Weber	, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.
Weber	, u., Schaller, U Elinumung in das Guntulining, 12. Aunage, Sidugart 2000.

Course L0882: Project Entrepreneurship	
Тур	Problem-based Learning
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,
	using their knowledge from the corresponding lecture.
	Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Focus Theoretical Mechanical Engineering

The graduates acquire basic research and methodological oriented content mechanical engineering knowledge and associated mechanical engineering expertise to develop mathematical descriptions, analysis and synthesis of basic technical systems methods, products or processes. This course, concentrates on simulation technology, advanced mathematics and heat transfer, such that a continuous study in the Master program in Theoretical Mechanical Engineering is possible.

Courses				
Fitle		Tun	Hrs/wk	СР
	NI / LODGA \	Тур	nrs/wk 2	2
Advanced Mechanical Engineering Desigr Advanced Mechanical Engineering Desigr		Lecture Recitation Section (large)	2	1
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Module Responsible				
Admission Requirements	None			
Recommended Previous	Fundamentals of Mechanical Engineering Design			
Knowledge	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
	ů ů			
Educational Objectives	After taking part successfully, students have reached the following learn	ing results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	explain complex working principles and functions of machine elements.	ements and of basic elements of fluid	dics,	
	explain requirements, selection criteria, application scenarios at	nd practical examples of complex ma	chine elements,	
	 indicate the background of dimensioning calculations. 			
Skilla	After pessing the module students are able to:			
Skills	After passing the module, students are able to:			
	 accomplish dimensioning calculations of covered machine elem 	nents,		
	transfer knowledge learned in the module to new requirements.	and tasks (problem solving skills),		
	recognize the content of technical drawings and schematic skets			
	evaluate complex designs, technically.			
	, , , , , , , , , , , , , , , , , , , ,			
Personal Competence				
Social Competence				
	Students are able to discuss technical information in the lecture	supported by activating methods.		
Autonomy				
	 Students are able to independently deepen their acquired know 	ledge in exercises.		
	 Students are able to acquire additional knowledge and to re 	capitulate poorly understood conte	nt e.g. by using the	video recordings of
	lectures.			
Workload in Hours	lectures. Independent Study Time 68, Study Time in Lecture 112			
Workload in Hours Credit points				
	Independent Study Time 68, Study Time in Lecture 112			
Credit points	Independent Study Time 68, Study Time in Lecture 112			
Credit points Examination	Independent Study Time 68, Study Time in Lecture 112 6 Written exam	anical Engineering, Focus Energy Sy	stems: Compulsory	
Credit points Examination Examination duration and scale	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha			Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha	anical Engineering, Focus Aircraft Sy	stems Engineering: 0	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials	stems Engineering: C in Engineering Scien	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatror	stems Engineering: Con Engineering Science Compulsory	ces: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatror anical Engineering, Focus Product D	stems Engineering: Con Engineering Scientifics: Compulsory evelopment and Proc	ces: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product D anical Engineering, Focus Theoretica	stems Engineering: C in Engineering Scien- nics: Compulsory evelopment and Proc al Mechanical Engine	ces: Compulsory duction: Compulsory ering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatror anical Engineering, Focus Product D anical Engineering, Focus Theoretics sation Mechanical Engineering, Focus	stems Engineering: C in Engineering Scien- nics: Compulsory evelopment and Proc al Mechanical Engine is Aircraft Systems Er	ces: Compulsory duction: Compulsory ering: Compulsory ngineering: Compulso
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialis General Engineering Science (German program, 7 semester): Specialis	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatror anical Engineering, Focus Product D anical Engineering, Focus Theoretics sation Mechanical Engineering, Focus	stems Engineering: C in Engineering Scien- nics: Compulsory evelopment and Proc al Mechanical Engine is Aircraft Systems Er	ces: Compulsory duction: Compulsory ering: Compulsory ngineering: Compulso
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatror anical Engineering, Focus Product D anical Engineering, Focus Theoretics sation Mechanical Engineering, Focus	stems Engineering: C in Engineering Scien- nics: Compulsory evelopment and Proc al Mechanical Engine is Aircraft Systems Er	ces: Compulsory duction: Compulsory ering: Compulsory ngineering: Compulso
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialis General Engineering Science (German program, 7 semester): Specialis	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product D anical Engineering, Focus Theoretica sation Mechanical Engineering, Focusialisation Mechanical Engineering,	stems Engineering: C in Engineering Scien- nics: Compulsory evelopment and Proc al Mechanical Engine as Aircraft Systems Er Focus Materials in	ces: Compulsory duction: Compulsory pering: Compulsory ngineering: Compulso Engineering Science
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product D anical Engineering, Focus Theoretica sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus ation Mechanical Engineering, Focus	stems Engineering: C in Engineering Scien- nics: Compulsory evelopment and Proc al Mechanical Engine is Aircraft Systems Er Focus Materials in	ces: Compulsory duction: Compulsory ering: Compulsory ngineering: Compulso Engineering Scienc
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha General Engineering Scie	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product D anical Engineering, Focus Theoretica sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus ation Mechanical Engineering, Focus	stems Engineering: C in Engineering Scien- nics: Compulsory evelopment and Proc al Mechanical Engine is Aircraft Systems Er Focus Materials in	ces: Compulsory duction: Compulsory ering: Compulsory ngineering: Compulso Engineering Scienc
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program): Mecha General Engineering Science (German program): Mecha General Engineering Science (German program): Mecha Ge	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product D anical Engineering, Focus Theoretica sation Mechanical Engineering, Focus cialisation Mechanical Engineering, Focus ation Mechanical Engineering, Focus alisation Mechanical Engineering, Focus alisation Mechanical Engineering, Focus	stems Engineering: C in Engineering Scien- nics: Compulsory evelopment and Proc al Mechanical Engine is Aircraft Systems Er Focus Materials in is Mechatronics: Com ocus Product Develo	ces: Compulsory duction: Compulsory ering: Compulsory ngineering: Compulso Engineering Scienc npulsory opment and Producti
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha General Engineering Scie	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product D anical Engineering, Focus Theoretica sation Mechanical Engineering, Focus cialisation Mechanical Engineering, Focus ation Mechanical Engineering, Focus alisation Mechanical Engineering, Focus alisation Mechanical Engineering, Focus	stems Engineering: C in Engineering Scien- nics: Compulsory evelopment and Proc al Mechanical Engine is Aircraft Systems Er Focus Materials in is Mechatronics: Com ocus Product Develo	ces: Compulsory duction: Compulsory ering: Compulsory ngineering: Compulso Engineering Scienc npulsory opment and Producti
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mechageneral Engineering Science (German program, 7 semester): Specialisation Mechageneral Engineering Scienc	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product D anical Engineering, Focus Theoretica sation Mechanical Engineering, Focus cialisation Mechanical Engineering, Focus alisation Mechanical Engineering, Focus alisation Mechanical Engineering, Facus alisation Mechanical Engineering, Facus alisation Mechanical Engineering,	stems Engineering: C in Engineering Scien- nics: Compulsory evelopment and Proc al Mechanical Engine is Aircraft Systems Er Focus Materials in is Mechatronics: Com focus Product Develo	duction: Compulsory duction: Compulsory dering: Compulsory ngineering: Compulsor Engineering Science apulsory dependent and Producti
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mechageneral Engineering Science (German program, 7 semester): Specialisation Mechageneral Engineering Scienc	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product D anical Engineering, Focus Theoretica ation Mechanical Engineering, Focus cialisation Mechanical Engineering, Focus ation Mechanical Engineering, Focus alisation Mechanical Engineering, Focus alisation Mechanical Engineering, Focus ation Mechanical Engineering, Focus	stems Engineering: Con Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems En Focus Materials in us Mechatronics: Compose Product Development and Procus Theoretical Mes Biomechanics: Con is Biomechanics: Con in the Engineering in the Procus Product Development in the Procus Theoretical Mes	duction: Compulsory duction: Compulsory dering: Compulsory ngineering: Compulsor Engineering Science apulsory dependent and Producti dechanical Engineeri
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product D anical Engineering, Focus Theoretica ation Mechanical Engineering, Focus cation Mechanical Engineering, Focus alisation Mechanical Engineering, Focus alisation Mechanical Engineering, Focus ation Mechanical Engineering, Focus	stems Engineering: Con Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems En Focus Materials in Secus Product Development and Procus Product Development Secus Theoretical Materials in Secus Energy Systems: Constant Energy Systems: Const	duction: Compulsory duction: Compulsory dering: Compulsory ngineering: Compulsor Engineering Science apulsory dependent and Producti dechanical Engineeri
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha	anical Engineering, Focus Aircraft Sy anical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product D anical Engineering, Focus Theoretics ation Mechanical Engineering, Focus italisation Mechanical Engineering, Focus alisation Mechanical Engineering, Focus alisation Mechanical Engineering, Focus ation Mechanical Engineering, Focus anical Engineering, Focus Energy Sy	stems Engineering: Con Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems Enfocus Materials in Secus Product Development and Procus Product Development Secus Theoretical Materials in Secus Energy Systems: Costems: Compulsory	duction: Compulsory duction: Compulsory dering: Compulsory regineering: Compulsory dingering: Compulsory dering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (English program): Specialisation Mecha General Engineering Science (English program): Specialisation Mecha General Engineering Science (English program): Specialisation Mecha	anical Engineering, Focus Aircraft Syanical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product Danical Engineering, Focus Theoretical Engineering, Focus Institution Mechanical Engineering, Focus Institution Institution, Focus Institution Institution, Focus Institution, F	stems Engineering: Con Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems Engine is Mechatronics: Compulsory Product Development and Procus Product Development in the Engineering Systems: Costems: Compulsory stems Engineering: Control Engineer	duction: Compulsory duction: Compulsory dering: Compulsory regineering: Compulsor Engineering Science duction: Compulsor duction ducti
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation General Engineering Science (English program): Specialisation Mecha	anical Engineering, Focus Aircraft Syanical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Product Danical Engineering, Focus Theoretics ation Mechanical Engineering, Focus Institution Mechanical Engineering, Focus Energy Synical Engineering, Focus Aircraft Syanical Engineering, Focus Materials i Institution	stems Engineering: Con Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems En Focus Materials in Secus Product Development and Procus Product Development Secus Theoretical Materials: Con is Energy Systems: Costems: Compulsory stems Engineering: Con Engineering Science	duction: Compulsory duction: Compulsory dering: Compulsory regineering: Compulsor Engineering Science duction: Compulsor duction ducti
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (English program): Specialisation Mecha	anical Engineering, Focus Aircraft Syanical Engineering, Focus Materials anical Engineering, Focus Mechatron anical Engineering, Focus Theoretical Engineering, Focus Theoretical Engineering, Focus Installing Mechanical Engineering, Focus Installing Installing Focus Installing Installing Focus Installing Installing Focus Mechanical Engineering, Focus Materials in Installing Installing Focus Mechanical Engineering, Focus Mechanical Installing Focus Mechanical Engineering, Focus	stems Engineering: Con Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems En Focus Materials in Sus Mechatronics: Compulsory Energy Systems: Costems: Compulsory stems Engineering: Con Engineering: Con Engineering Sciencics: Compulsory	duction: Compulsory duction: Compulsory duction: Compulsory dering: Compulsory agineering: Compulsor Engineering Science duction ducti
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (English program): Specialisation Mecha	anical Engineering, Focus Aircraft Syanical Engineering, Focus Mechatron anical Engineering, Focus Mechatron anical Engineering, Focus Theoretical Engineering, Focus Theoretical Engineering, Focus Theoretical Engineering, Focus Theoretical Engineering, Focus Instation Mechanical Engineering, Focus Energy Synical Engineering, Focus Aircraft Syanical Engineering, Focus Materials in Instation Engineering, Focus Mechatron Instal Engineering, Focus Mechatron Instal Engineering, Focus Mechatron Instal Engineering, Focus Product Department of the Instantion	stems Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems En Focus Materials in Secus Product Develor Focus Theoretical Messenger Systems: Constems: Compulsory stems Engineering: Con Engineering Sciencics: Compulsory evelopment and Product In Engineering Sciencics: Compulsory evelopment and Productics: Compulsory evelopment evelopment evelopment even evelopment evelopment evelopment even evelopment even even even even even even even e	duction: Compulsory duction: Compulsory duction: Compulsory dering: Compulsory dering: Compulsory dering: Compulsory dering: Compulsory dering: Compulsory dechanical Engineeri
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (English program): Specialisation Mecha	anical Engineering, Focus Aircraft Syanical Engineering, Focus Mechatron anical Engineering, Focus Mechatron anical Engineering, Focus Theoretical Engineering, Focus Theoretical Engineering, Focus Theoretical Engineering, Focus Theoretical Engineering, Focus Instation Mechanical Engineering, Focus Energy Synical Engineering, Focus Aircraft Syanical Engineering, Focus Materials in Instation Engineering, Focus Mechatron Instal Engineering, Focus Mechatron Instal Engineering, Focus Mechatron Instal Engineering, Focus Product Department of the Instantion	stems Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems En Focus Materials in Secus Product Develor Focus Theoretical Messenger Systems: Constems: Compulsory stems Engineering: Con Engineering Sciencics: Compulsory evelopment and Product In Engineering Sciencics: Compulsory evelopment and Productics: Compulsory evelopment evelopment evelopment even evelopment evelopment evelopment even evelopment even even even even even even even e	duction: Compulsory duction: Compulsory duction: Compulsory dering: Compulsory dering: Compulsory dering: Compulsory dering: Compulsory dering: Compulsory dechanical Engineeri
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (English program): Specialisation Mecha	anical Engineering, Focus Aircraft Syanical Engineering, Focus Mechatron anical Engineering, Focus Mechatron anical Engineering, Focus Theoretica attion Mechanical Engineering, Focus Instation Mechanical Engineering, Focus Materials in Instation Instation, Focus Mechanical Engineering, Focus Theoretical	stems Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems En Focus Materials in Secus Product Develors Theoretical Messensers Compulsory stems Engineering: Con Engineering: Con Engineering Sciencics: Compulsory evelopment and Product Engineering In Mechanical Engineering In En	duction: Compulsory duction: Compulsory duction: Compulsory dering: Compulsory duction: Compulsory duction: Compulsory duction: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (English program): Specialisation Mecha	anical Engineering, Focus Aircraft Syanical Engineering, Focus Mechatron anical Engineering, Focus Mechatron anical Engineering, Focus Theoretica ation Mechanical Engineering, Focus Itsation Mechanical Engineering, Focus Materials inical Engineering, Focus Mechatron nical Engineering, Focus Theoretica ation Mechanical Engineering,	stems Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems Engineering: Con Engineering Sciencics: Compulsory evelopment and Prod I Mechanical Engineers Aircraft Systems En	duction: Compulsory duction: Compulsory duction: Compulsory dering: Compulsory dering: Compulsory dering: Compulsory dering: Compulsory dechanical Engineeri
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (English program): Specialisation Mecha	anical Engineering, Focus Aircraft Syanical Engineering, Focus Mechatron anical Engineering, Focus Mechatron anical Engineering, Focus Theoretica ation Mechanical Engineering, Focus Itsation Mechanical Engineering, Focus Materials inical Engineering, Focus Mechatron nical Engineering, Focus Theoretica ation Mechanical Engineering,	stems Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems Engineering: Con Engineering Sciencics: Compulsory evelopment and Prod I Mechanical Engineers Aircraft Systems En	duction: Compulsory duction: Compulsory duction: Compulsory dering: Compulsory dering: Compulsory dering: Compulsory dering: Compulsory dechanical Engineeri
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (English program): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisati	anical Engineering, Focus Aircraft Syanical Engineering, Focus Mechatron anical Engineering, Focus Mechatron anical Engineering, Focus Theoretica ation Mechanical Engineering, Focus Instanton Mechanical Engineering, Focus Materials in inical Engineering, Focus Mechatron inical Engineering, Focus Product Denical Engineering, Focus Theoretica ation Mechanical Engineering, Focus Instanton Mechanical Engine	stems Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems Engineering: Con Engineering: Compulsory evelopment and Prod I Mechanical Engineers Aircraft Systems Enfocus Materials in	duction: Compulsory duction: Compulsory dering: Compulsory regineering: Compulsory regineering: Compulsory regineering: Compulsory regineering Science regineering dechanical Engineeri mpulsory regineering: Compulsory regineering: Compulsory gineering: Compulsory gineering: Compulsory regineering: Compulsory gineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 68, Study Time in Lecture 112 6 Written exam 120 General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (German program, 7 semester): Specialisation Mecha General Engineering Science (English program): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha General Engineering Science (English program, 7 semester): Specialisation Mecha	anical Engineering, Focus Aircraft Syanical Engineering, Focus Mechatron anical Engineering, Focus Mechatron anical Engineering, Focus Theoretica ation Mechanical Engineering, Focus Itsation Mechanical Engineering, Focus Materials inical Engineering, Focus Mechatron nical Engineering, Focus Theoretica ation Mechanical Engineering, Focus Itsation Mechanical Engineerin	stems Engineering: Con Engineering Scientics: Compulsory evelopment and Procal Mechanical Engine is Aircraft Systems Engineering: Con Engineering: Compulsory evelopment and Prod I Mechanical Engineers Aircraft Systems Enfocus Materials in Science in Engineering: Compulsory evelopment and Prod I Mechanical Engineers Aircraft Systems Enfocus Materials in Science in Engineering: Compulsory evelopment and Prod I Mechanical Engineers Aircraft Systems Enfocus Materials in Science in Engineering: Compulsory evelopment and Prod I Mechanical Engineers Aircraft Systems Enfocus Materials in Science in Engineering: Compulsory exception in Engineering Engineer	duction: Compulsory duction: Compulsory dering: Compulsory regineering: Compulsory regineering: Compulsory regineering: Compulsory regineering Science regineering dechanical Engineeri mpulsory regineering regineering: Compulsory regineering: Compulsory gineering: Compulsory gineering: Compulsory regineering: Compulsory gineering: Compulsory



General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Mechanical Engineering: Core qualification: Compulsory

Naval Architecture: Core qualification: Compulsory

Course L0264: Advanced Mechanic	al Engineering Design II
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	SoSe
Content	Advanced Mechanical Engineering Design I & II
	Lecture
	Fundamentals of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Seals
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank drives
	Sliding bearings
	Elements of fluidics
	Exercise
	Calculation methods of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	• Crank gears
	Sliding bearings
	Calculations of hydrostatic systems (fluidics)
Literature	
	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Tit (The problem of the Public of t
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. Konstalling in die DIN-Normen; Klein, M., Teubner-Verlag.
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Bücher zu speziellen Themen

Course L0265: Advanced Mechanical Engineering Design II	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0262: Advanced Mechanic	al Engineering Design I
	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	Advanced Mechanical Engineering Design I & II
Content	Advanced Mechanical Engineering Design Facility
	Lecture
	Fundamentals of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Seals
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank drives
	 Sliding bearings
	Elements of fluidics
	Exercise
	Calculation methods of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears Carolinaser
	• Crank gears
	Sliding bearings
	Calculations of hydrostatic systems (fluidics)
Literature	
	 Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	 Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Savia waitara Büchar zu caaziallan Thoman
	Sowie weitere Bücher zu speziellen Themen

Course L0263: Advanced Mechanical Engineering Design I	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



ourses	
tle	Typ Hrs/wk CP
	Typ Hrs/wk CP Lecture 3 4
gnals and Systems (L0432) gnals and Systems (L0433)	Recitation Section (large) 1 2
Module Responsible	Prof. Gerhard Bauch
Admission Requirements	None
Recommended Previous	Mathematics 1-3
Knowledge	matternates 1-3
Momeage	The modul is an introduction to the theory of signals and systems. Good knowledge in maths as covered by the moduls Mathematik 1-3 is experience with spectral transformations (Fourier series, Fourier transform, Laplace transform) is useful but not required.
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The students are able to classify and describe signals and linear time-invariant (LTI) systems using methods of signal and system theory. They are
	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse deterministic s
	and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image domain whi
	caused by the transition of a continuous-time signal to a discrete-time signal.
Skills	The students are able to describe and analyse deterministic signals and linear time-invariant systems using methods of signal and system theory
	can analyse and design basic systems regarding important properties such as magnitude and phase response, stability, linearity etc They can a
	the impact of LTI systems on the signal properties in time and frequency domain.
Personal Competence	
Social Competence	The students can jointly solve specific problems.
Autonomy	The students are able to acquire relevant information from appropriate literature sources. They can control their level of knowledge during the l
,	period by solving tutorial problems, software tools, clicker system.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
•	
Examination	Written exam
Examination duration and scale	90 min
Assignment for the Following	General Engineering Science (German program): Specialisation Electrical Engineering: Compulsory
Curricula	General Engineering Science (German program): Specialisation Computer Science: Compulsory
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Civil- and Enviromental Engeneering: Compulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Computer Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Computer Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Computer Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Computer Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Computer Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Computer Science (German program): Specialisation
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sci Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engine
	Compulsory
	Computer Science: Core qualification: Compulsory
	Electrical Engineering: Core qualification: Compulsory
	General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Computer Science: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compu
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sci
	Compulsory General Engineering Science (English program 7 semester): Specialisation Mechanical Engineering Engineering Engineering Engineering
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engine
	Compulsory
	Computational Science and Engineering: Core qualification: Compulsory



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	S
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN SoSe
Content	Basic classification and description of continuous-time and discrete-time signals and systems
	Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)
	Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

Course L0433: Signals and Systems	s
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



priate method
sory
Compulsory
Compulsory
ng: Compulso
and Producti
cal Engineeri
ory
Compulsory
ompulsory
ng: Compulso
and Producti
al Engineeri
cal Engineeri
S ()



Course L0266: Advanced Mechanic	al Design Project
Тур	Practical Course
Hrs/wk	4
СР	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff, Dr. Jens Schmidt, Dr. Volkert Wollesen
Language	DE
Cycle	WiSe
Content	Das Konstruktionsprojekt gliedert sich in den Entwurf eines Getriebes sowie die Lösungsfindung.
	Getriebekonstruktion in Einzelarbeit
	Erarbeitung von Lösungsprinzipien
	Berechnung von Maschinenelementen
	Entwurf eines Getriebes im Hauptschnitt plus allen Außenansichten
	 Erstellung einer ausführlichen Dokumentation Lösungsfindung
	Methodische Erarbeitung von prinzipiellen Lösungskonzepten
	Erstellen einer Dokumentation
Literature	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	 Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Bücher zu speziellen Themen



Module M0684: Heat Trans	fer			
Courses				
Γitle		Тур	Hrs/wk	CP
Heat Transfer (L0458)		Lecture	3	4
Heat Transfer (L0459)		Recitation Section (large)	2	2
Module Responsible	Dr. Andreas Moschallski			
Admission Requirements	none			
Recommended Previous	Technical Thermodynamics I, II and Fluid Dynamics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	The students are able to			
	- describe the different physical mechanism of Heat Transfer,			
	- explain the technical terms,			
	- to analyse comlex heat transfer processes in a critical way.			
Skills	The students are able to			
	- understand the physics of Heat Transfer,			
	- calculate and evaluate complex Heat Transfer processes,			
	- solve excersises self-consistent and in small groups.			
Personal Competence				
Social Competence	The students are able to discuss in small groups and develop ar	approach.		
Autonomy	The students are able to develop a complex problem self-consis	stent and analyse the results in a critical wa	y. A qualified exchan	ge with other students
	given.			
Waster of the Harris	Indicated at Oracle Track 140, Oracle Track 14, 14, 14, 170			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Biomecha	anics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Energy Sy	ystems: Compulsory	
	General Engineering Science (German program): Specialisation	Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Theoretic	al Mechanical Engine	ering: Compulsory
	General Engineering Science (German program, 7 semester): S	pecialisation Mechanical Engineering, Foci	us Energy Systems: C	ompulsory
	General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering,	Focus Theoretical N	lechanical Engineerir
	Compulsory			
	General Engineering Science (German program, 7 semester): S		pulsory	
	General Engineering Science (English program): Specialisation	Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Biomecha	nics: Compulsory	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): Sp			
	General Engineering Science (English program, 7 semester) Compulsory	Specialisation Mechanical Engineering,	Focus Theoretical N	lechanical Engineerir
	General Engineering Science (English program, 7 semester): Sp	ecialisation Biomedical Engineering: Com	pulsory	
	Mechanical Engineering: Specialisation Energy Systems: Comp		*	
	Mechanical Engineering: Specialisation Theoretical Mechanical			

Course L0458: Heat Transfer	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Dr. Andreas Moschallski
Language	DE
Cycle	WiSe
Content	Dimensional analysis, heat conduction, convective heat transfer, Two-phase heat transfer (evaporation, condensation), thermal radiation, heat exchangers, measurement methods
Literature	- Herwig, H.; Moschallski, A.: Wärmeübertragung, 3. Auflage, Springer Vieweg Verlag, Wiesbaden, 2014 - Herwig, H.: Wärmeübertragung von A-Z, Springer- Verlag, Berlin, Heidelberg, 2000
	- Baehr, H.D.; Stephan, K.: Wärme- und Stoffübertragung, 2. Auflage, Springer Verlag, Berlin, Heidelberg, 1996



Course L0459: Heat Transfer	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Andreas Moschallski
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses				
Γitle	Тур		Hrs/wk	CP
Computer Engineering (L0321) Computer Engineering (L0324)	Lect Rec	ure itation Section (small)	3 1	4
Module Responsible	Prof. Heiko Falk	itation occiton (smail)	· · · · · · · · · · · · · · · · · · ·	L
Admission Requirements	None			
Recommended Previous	Basic knowledge in electrical engineering			
Knowledge				
	The successful completion of the labs will be honored during the evaluation of th	e module's examination ac	cording to the following	ng rules:
	1. Upon a passed module examination, the student is granted a bonus	on the examination's mar	rks due to the succes	ssful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-b	etter grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not pos	ssible.		
Educational Objectives	After taking part successfully, students have reached the following learning resul	ts		
Professional Competence	The factor of th			
Knowledge	This module deals with the foundations of the functionality of computing syste	ms. It covers the lavers fro	om the assembly-leve	el programming down
	gates. The module includes the following topics:			p. eg. ag
	Introduction			
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardwa	re synthesis, combinationa	al networks	
	 Sequential logic: Flip-flops, automata, systematic hardware design Technological foundations 			
	Computer arithmetic: Integer addition, subtraction, multiplication and division.	sion		
	Basics of computer architecture: Programming models, MIPS single-cycle			
	Memories: Memory hierarchies, SRAM, DRAM, caches	. a. o		
	 Input/output: I/O from the perspective of the CPU, principles of passing da 	ta, point-to-point connectio	ons, busses	
Skills	The students perceive computer systems from the architect's perspective, i.e.			
	computer systems. The students can analyze, how highly specific and individual systems. They are able to distinguish between and to explain the different			
	components. They are able to distinguish between and to explain the different a up to complete processors.	abstraction layers of todays	s computing systems	- Irom gales and circl
	up to complete processors.			
	After successful completion of the module, the students are able to judge the in	terdependencies between	a physical computer	system and the softwa
	executed on it. In particular, they shall understand the consequences that the ex	xecution of software has or	the hardware-centri	c abstraction layers fr
	the assembly language down to gates. This way, they will be enabled to evaluat	e the impact that these low	abstraction levels ha	ve on an entire syste
	performance and to propose feasible options.			
Personal Competence				
Social Competence	Students are able to solve similar problems alone or in a group and to present th	e results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific literature and to associ	ciate this knowledge with of	ther classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes, contents of course and labs			
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsor	у		
Curricula	General Engineering Science (German program, 7 semester): Specialisation Co	mputer Science: Compulso	ory	
	General Engineering Science (German program, 7 semester): Specialisation Bio			
	General Engineering Science (German program, 7 semester): Specialisation Na		•	
	General Engineering Science (German program, 7 semester): Specialisation Civ		•	
	General Engineering Science (German program, 7 semester): Specialisation Ele			
	General Engineering Science (German program, 7 semester): Specialisation Bio			
	General Engineering Science (German program, 7 semester): Specialisation En-	• •		у
	General Engineering Science (German program, 7 semester): Specialisation Program, 7	ocess ⊑ngmeering: Compu	ISULY	
		chanical Engineering Foo	us Mechatronico: Con	nnulsony
	General Engineering Science (German program, 7 semester): Specialisation Me			
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me	chanical Engineering, Foc	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Specialisation Me	chanical Engineering, Foc chanical Engineering, Foc	us Biomechanics: Co us Aircraft Systems Er	mpulsory ngineering: Compulso
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me	chanical Engineering, Foc chanical Engineering, Foc	us Biomechanics: Co us Aircraft Systems Er	mpulsory ngineering: Compulso
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation	chanical Engineering, Foci chanical Engineering, Foci Mechanical Engineering	us Biomechanics: Col us Aircraft Systems Er I, Focus Materials in	mpulsory ngineering: Compulso Engineering Science
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory	chanical Engineering, Foci chanical Engineering, Foci Mechanical Engineering	us Biomechanics: Col us Aircraft Systems Er I, Focus Materials in	mpulsory ngineering: Compulso Engineering Science
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation	chanical Engineering, Foci chanical Engineering, Foci n Mechanical Engineering Mechanical Engineering,	us Biomechanics: Co us Aircraft Systems En , Focus Materials in Focus Theoretical M	mpulsory ngineering: Compulso Engineering Scienc flechanical Engineeri
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory	chanical Engineering, Foci chanical Engineering, Foci n Mechanical Engineering Mechanical Engineering,	us Biomechanics: Co us Aircraft Systems En , Focus Materials in Focus Theoretical M	mpulsory ngineering: Compulso Engineering Scienc flechanical Engineeri
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation	chanical Engineering, Focichanical Engineering, Focin Mechanical Engineering Mechanical Engineering, Mechanical Engineering, focichanical Engineer	us Biomechanics: Cous Aircraft Systems En Focus Materials in Focus Theoretical Materials In	mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory	chanical Engineering, Focichanical Engineering, Focin Mechanical Engineering Mechanical Engineering, Mechanical Engineering, focichanical Engineer	us Biomechanics: Cous Aircraft Systems En Focus Materials in Focus Theoretical Materials In	mpulsory ngineering: Compulso Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Me	chanical Engineering, Focichanical Engineering, Focin Mechanical Engineering Mechanical Engineering, Mechanical Engineering, focichanical Engineer	us Biomechanics: Cous Aircraft Systems En Focus Materials in Focus Theoretical Materials In	mpulsory ngineering: Compulso Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Me Computer Science: Core qualification: Compulsory	chanical Engineering, Focichanical Engineering, Focich Mechanical Engineering, Mechanical Engineering, Mechanical Engineering, I Chanical Engineering, Focichanical Engineerin	us Biomechanics: Cous Aircraft Systems En Focus Materials in Focus Theoretical Materials In	mpulsory ngineering: Compulso Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Me Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Confidence (English program): Specialisation Confidence (English program): Specialisation Confidence (English program): Specialisation Confidence (Engl	chanical Engineering, Focichanical Engineering, Focin Mechanical Engineering, Mechanical Engineering, Mechanical Engineering, I Chanical Engineering, Foci	us Biomechanics: Coi us Aircraft Systems Er i, Focus Materials in Focus Theoretical M Focus Product Develous Energy Systems: C	mpulsory ngineering: Compulso Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Me Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Core General Engineering Science (English program, 7 semester): Specialisation Bio	chanical Engineering, Focichanical Engineering, Focin Mechanical Engineering, Mechanical Engineering, Mechanical Engineering, Focial Chanical Engineering, Focial Chanical Engineering, Focial Chanical Engineering, Focial	us Biomechanics: Coi us Aircraft Systems Er i, Focus Materials in Focus Theoretical M Focus Product Develous us Energy Systems: Cory pulsory	mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Me Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Core General Engineering Science (English program, 7 semester): Specialisation Bio General Engineering Science (English program, 7 semester): Specialisation Nav	chanical Engineering, Focichanical Engineering, Focin Mechanical Engineering, Mechanical Engineering, Mechanical Engineering, I Chanical Engineering, Focichanical Engineering	us Biomechanics: Coi us Aircraft Systems Er i, Focus Materials in Focus Theoretical M Focus Product Develous us Energy Systems: Cory ry pulsory	mpulsory ngineering: Compulso Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Me Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Core General Engineering Science (English program, 7 semester): Specialisation Bio General Engineering Science (English program, 7 semester): Specialisation National Science (English program, 7 semester): Specialisation National Science (English program, 7 semester): Specialisation Core	chanical Engineering, Focichanical Engineering, Focin Mechanical Engineering, Mechanical Engineering, Mechanical Engineering, Focichanical Engineering: Compulsor, val Architecture: Compulsor, val Architecture: Compulsor, Il Engineering: Compulsor,	us Biomechanics: Coi us Aircraft Systems Ei i, Focus Materials in Focus Theoretical M Focus Product Devel us Energy Systems: Co ry pulsory ry	mpulsory ngineering: Compulso Engineering Science Mechanical Engineeri opment and Producti
	General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Me General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Me Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Core General Engineering Science (English program, 7 semester): Specialisation Bio General Engineering Science (English program, 7 semester): Specialisation Nav	chanical Engineering, Focichanical Engineering, Focin Mechanical Engineering, Mechanical Engineering, Mechanical Engineering, Focichanical Engineering, Focichanical Engineering, Focichanical Engineering, Focichanical Engineering: Compulso process Engineering: Compulson all Engineering: Compulsory ctrical Engineering: Compulsory ctrical Engineering: Compulsory	us Biomechanics: Coi us Aircraft Systems Ei i, Focus Materials in Focus Theoretical M Focus Product Devel us Energy Systems: Co ry pulsory ry / / ulsory	mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri opment and Producti

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Computational Science and Engineering: Core qualification: Compulsory
Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	ng
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	 Introduction Combinational Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005.

Course L0324: Computer Engineeri	ng
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses	
Title	Typ Hrs/wk CP
Introduction to Control Systems (L0654) Introduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2
Module Responsible	
Admission Requirements	
Recommended Previous	
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	
· ·	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second control of the students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second control of the students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second control of the students can represent dynamic system behavior in time and frequency domain.
	systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus They can explain the Nyquist stability criterion and the stability margins derived from it.
	 They can explain the Nyquist stability criterion and the stability margins derived from it. They can explain the role of the phase margin in analysis and synthesis of control loops
	They can explain the role of the phase margin in analysis and synthesis of control loops They can explain the way a PID controller affects a control loop in terms of its frequency response
	They can explain the way a 115 controller alleds a controlled in continuous time domain are implemented digitally They can explain issues arising when controllers designed in continuous time domain are implemented digitally
	They can explain access along more continued accessing the more accessing to the continued and accessing the more accessing the continued accessing to the c
Skills	Students can transform models of linear dynamic systems from time to frequency domain and vice versa
	They can simulate and assess the behavior of systems and control loops
	They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules
	They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks
Personal Competence	
Social Competence	
Autonomy	
	problems.
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.
Wallandin Harre	Indianadas Chala Tara 104 Chala Tara in Lasture CO
Workload in Hours	
Credit points	6
Credit points Examination	6 Written exam
Credit points Examination Examination duration and scale	6 Written exam 120 min
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Credit points Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Pr
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Sci
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Operman program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Operman program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (Operman program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (Operman program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engine
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General En
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical En
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syste
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Electrica
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Genera
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Derman program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Derman program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems:
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Envirormental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program, 7 sem
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compul
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program, 7 semester): Specialisation Compulsory Gen
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Department of the Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (English prog
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program, 7 semester): Specialisation Compulsory Gen



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

 $General\ Engineering\ Science\ (English\ program,\ 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Aircraft\ Systems\ Engineering:\ Compulsory\ Specialisation\ Mechanical\ Engineering:\ Compulsory\ Mechanical\ Engineering:\ Mech$

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

Тур	Lecture		
Hrs/wk	2		
CP	4		
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28		
Lecturer	Prof. Herbert Werner		
Language	DE		
Cycle	WiSe		
Content	Signals and systems		
	Linear systems, differential equations and transfer functions		
	First and second order systems, poles and zeros, impulse and step response		
	Stability		
	Feedback systems		
	Principle of feedback, open-loop versus closed-loop control		
	Reference tracking and disturbance rejection		
	Types of feedback, PID control		
	System type and steady-state error, error constants		
	Internal model principle		
	Deat legge techniques		
	ot locus techniques		
	Root locus plots		
	Root locus design of PID controllers		
	quency response techniques		
	Bode diagram		
	Minimum and non-minimum phase systems		
	Nyquist plot, Nyquist stability criterion, phase and gain margin		
	Loop shaping, lead lag compensation		
	Frequency response interpretation of PID control		
	Time delay systems		
	Root locus and frequency response of time delay systems		
	Smith predictor		
	Digital control		
	Sampled-data systems, difference equations The formula of the first temperature of CVD controllers.		
	Tustin approximation, digital implementation of PID controllers		
	Software tools		
	Introduction to Matlab, Simulink, Control toolbox		
	Computer-based exercises throughout the course		
	Company according to the control of		
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"		
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009		
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010		
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010		



Course L0655: Introduction to Control Systems		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Herbert Werner	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Madela Mozos, Baralanda	Forting to			
Module M0725: Production	Engineering			
Courses				
Title		Тур	Hrs/wk	СР
Production Engineering I (L0608)		Lecture	2	2
Production Engineering I (L0612)		Recitation Section (large)	1	1
Production Engineering II (L0610)		Lecture	2	2
Production Engineering II (L0611)		Recitation Section (large)	1	1
Module Responsible	Prof. Wolfgang Hintze			
Admission Requirements	none			
Recommended Previous	no course assessments required			
Knowledge	no obarse assessments required			
ougo	internship recommended			
	A6			
Educational Objectives	After taking part successfully, students have reached the following lea	irning results		
Professional Competence				
Knowledge	Students are able to			
	and the standard for the contract of the standard for the			
	name basic criteria for the selection of manufacturing process	2 8.		
	name the main groups of Manufacturing Technology.			
	name the application areas of different manufacturing process			
	 name boundaries, advantages and disadvantages of the difference 			
	 describe elements, geometric properties and kinematic variab 	les and requirements for tools, workp	iece and process.	
	 explain the essential models of manufacturing technology. 			
Skills	Students are able to			
	 select manufacturing processes in accordance with the require 	ements.		
	 design manufacturing processes for simple tasks to meet the r 	equired tolerances of the component	to be produced.	
	assess components in terms of their production-oriented cons	truction.		
Personal Competence				
Social Competence	Students are able to			
30Clai Competence	Students are able to			
	 develop solutions in a production environment with qualified p 	ersonnel at technical level and repre	sent decisions.	
Autonomy	Ctudente are able to			
Autonomy	Students are able to			
	 interpret independently the manufacturing process. 			
	assess own strengths and weaknesses in general.			
	assess their learning progress and define gaps to be improve	d.		
	assess possible consequences of their actions.			
	222000 possilio sollosquettodo et aten deletto.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering	Focus Theoretical N	Mechanical Engineering:
Curricula	Elective Compulsory	zamana Enginooning	,	gooig.
Carriodia	General Engineering Science (German program, 7 semester): Spec	cialisation Mechanical Engineering	Focus Product David	onment and Production:
			. Sous i loudet Devel	op.nom and i rouddion.
	Compulsory	sieliesties Maskautust Frank	Facility Theory (1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	Anahaniaal Francisco
	General Engineering Science (English program, 7 semester): Spe	cialisation Mechanical Engineering	, ⊢ocus Ineoretical N	nechanical Engineering:
	Elective Compulsory			
	General Engineering Science (English program, 7 semester): Spec	cialisation Mechanical Engineering,	Focus Product Devel	opment and Production:
	Compulsory			
	Logistics and Mobility: Specialisation Engineering Science: Elective C	Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	· · · · · · · · · · · · · · · · · · ·			



Course L0608: Production Engineer	ing I
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Wolfgang Hintze
Language	DE
Cycle	WiSe
Content	 Manufacturing Accuracy Manufacturing Metrology Measurement Errors and Uncertainties Introduction to Forming Massiv forming and Sheet Metal Forming Introduction to Machining Technology Geometrically defined machining (Turning, milling, drilling, broaching, planning)
Literature	Dubbel, Heinrich (Grote, Karl-Heinrich.; Feldhusen, Jörg.; Dietz, Peter.; Ziegmann, Gerhard.;) Taschenbuch für den Maschinenbau : mit Tabellen. Berlin [u.a.] : Springer, 2007 Fritz, Alfred Herbert: Fertigungstechnik : mit 62 Tabellen. Berlin [u.a.] : Springer, 2004 Keferstein, Claus P (Dutschke, Wolfgang.;): Fertigungsmesstechnik : praxisorientierte Grundlagen, moderne Messverfahren. Wiesbaden : Teubner, 2008 Mohr, Richard: Statistik für Ingenieure und Naturwissenschaftler : Grundlagen und Anwendung statistischer Verfahren. Renningen : expert-Verl, 2008 Klocke, F., König, W.: Fertigungsverfahren Bd. 1 Drehen, Fäsen, Bohren. 8. Aufl., Springer (2008) Klocke, Fritz (König, Wilfried.;): Umformen. Berlin [u.a.] : Springer, 2006 Paucksch, E.: Zerspantechnik, Vieweg-Verlag, 1996 Tönshoff, H.K.; Denkena, B., Spanen. Grundlagen, Springer-Verlag (2004)

Course L0612: Production Engineering I		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Wolfgang Hintze	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0610: Production Engineer	ing II
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Wolfgang Hintze, Prof. Claus Emmelmann
Language	DE
Cycle	SoSe
Content	Geometrically undefined machining (grinding, lapping, honing) Introduction into erosion technology Introduction into blastig processes Introduction to the manufacturing process forming (Casting, Powder Metallurgy, Composites) Fundamentals of Laser Technology Process versions and Fundamentals of Laser Joining Technology
Literature	Klocke, F., König, W.: Fertigungsverfahren Bd. 2 Schleifen, Honen, Läppen, 4. Aufl., Springer (2005) Klocke, F., König, W.: Fertigungsverfahren Bd. 3 Abtragen, Generieren und Lasermaterialbearbeitung. 4. Aufl., Springer (2007) Spur, Günter (Stöferle, Theodor.;): Urformen. München [u.a.]: Hanser, 1981 Schatt, Werner (Wieters, Klaus-Peter,; Kieback, Bernd,;): Pulvermetallurgie: Technologien und Werkstoffe. Berlin [u.a.]: Springer, 2007



Course L0611: Production Engineering II		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Wolfgang Hintze, Prof. Claus Emmelmann	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1320: Simulation a	and Design of Mechatronic Systems			
	,			
Courses				
Title		Тур	Hrs/wk	CP
Simulation and Design of Mechatronic Syst		Lecture	2	2
Simulation and Design of Mechatronic Syst		Laboratory	1	2
Simulation and Design of Mechatronic Syst		Recitation Section (large)	1	2
Module Responsible				
Admission Requirements	None			
Recommended Previous	Fundatmentals of mechanics, control theory and electrical	engineering		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the f	ollowing learning results		
Professional Competence				
Knowledge	Students are able to describe methods and calculations for	r design, modeling, simulation and optimization	of mechatronic system	ns.
01.71	Objects are able to such an above the filters for and	allian of another trade and an Theorem and Ideas	for also later and day	ton atomita and an area
Skills	Students are able to apply modern algorithms for mod	eling of mechatronic systems. They can identi	ty, simulate and des	ign simple systems and
	implement those in laboratory conditions.			
Personal Competence				
Social Competence	Students are able to work goal-oriented in small mixed gro	oups and present results to target groups.		
Autonomy	Students are able to recognize and improve knowledge de	eficits independently.		
	With instructor assistance, students are able to evaluate the	eir own knowledge level and define a further co	urse of study.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		· · · · · · · · · · · · · · · · · · ·	
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Special	isation Mechanical Engineering, Focus Mechatro	nics: Compulsory	
Curricula	General Engineering Science (German program): Special			Compulsory
	General Engineering Science (German program): Special			
	General Engineering Science (German program, 7 semes			
	General Engineering Science (German program, 7 semes	, ,		
	General Engineering Science (German program, 7 sen		•	
	Elective Compulsory	, , , , , , , , , , , , , , , , , , ,	,	3 3
	General Engineering Science (English program): Speciali	sation Mechanical Engineering, Focus Aircraft S	vstems Engineering: (Compulsory
	General Engineering Science (English program): Speciali			
	General Engineering Science (English program): Speciali			ering: Compulsory
	General Engineering Science (English program, 7 semes	• •	•	
	General Engineering Science (English program, 7 semes			
	General Engineering Science (English program, 7 sem	, ,	•	
	Elective Compulsory	, -,		
	Mechanical Engineering: Specialisation Aircraft Systems I	Engineering: Compulsory		
	Mechanical Engineering: Specialisation Mechatronics: Co			
	Mechanical Engineering: Specialisation Theoretical Mech	• •		
	Mechatronics: Core qualification: Compulsory			

Course L1822: Simulation and Design of Mechatronic Systems		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	Mechatronic Design	
	Modeling	
	Model Identifikation	
	Numerical Methods in simulation	
	Applications and examples in Matlab [®] and Simulink [®]	
Literature	Skript zur Veranstaltung	
	Weitere Literatur in der Veranstaltung	



Course L1824: Simulation and Design of Mechatronic Systems		
Тур	Laboratory	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1823: Simulation and Design	urse L1823: Simulation and Design of Mechatronic Systems		
Тур	Recitation Section (large)		
Hrs/wk	1		
CP	2		
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14		
Lecturer	Prof. Uwe Weltin		
Language	DE		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		



Module M0854: Mathematic	es IV				
Courses					
Title			Тур	Hrs/wk	СР
Differential Equations 2 (Partial Differential	Equations) (L1043)		Lecture	2	1
Differential Equations 2 (Partial Differential	Equations) (L1044)		Recitation Section (small)	1	1
Differential Equations 2 (Partial Differential	Equations) (L1045)		Recitation Section (large)	1	1
Complex Functions (L1038)			Lecture	2	1
Complex Functions (L1041) Complex Functions (L1042)			Recitation Section (small) Recitation Section (large)	1	1
	Prof. Anusch Taraz		necitation Section (large)	1	ı
Module Responsible					
Admission Requirements	none				
Recommended Previous	Mathematics 1 - III				
Knowledge					
Educational Objectives	After taking part successfully, students have reached the foll	llowing learning i	esults		
Professional Competence					
Knowledge	Students can name the basic concepts in Mathemati	ics IV. They are a	able to explain them using approp	oriate examples.	
	Students can discuss logical connections between the students can discuss logical connections.				ith the help of examples
	They know proof strategies and can reproduce them				
Skills					
	Students can model problems in Mathematics IV wit	th the help of the	concepts studied in this course.	Moreover, they are	capable of solving ther
	by applying established methods.				
	Students are able to discover and verify further logic				
	For a given problem, the students can develop and expenses the st	execute a suitabl	e approach, and are able to critic	ally evaluate the re	sults.
Personal Competence					
Social Competence	Students are able to work together in teams. They ar	re canable to use	mathematics as a common land	liade	
	In doing so, they can communicate new concepts a				can design examples t
	check and deepen the understanding of their peers.		noodo or aren ocoperating parane	5.0. mo.oo.o., a.o,	oan doolgn oxampioo t
	chock and doopon the understanding of their poore.				
Autonomy					
Autonomy	 Students are capable of checking their understandi 	ing of complex c	oncepts on their own. They can	specify open ques	tions precisely and know
	where to get help in solving them.				
	 Students have developed sufficient persistence to be 	e able to work fo	r longer periods in a goal-oriente	d manner on hard p	oroblems.
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112				
Credit points	6				
Examination	Written exam				
Examination duration and scale	60 min (Complex Functions) + 60 min (Differential Equations	ns 2)			
Assignment for the Following	General Engineering Science (German program): Specialisa	sation Electrical E	Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialise	sation Mechanica	I Engineering, Focus Mechatroni	cs: Compulsory	
	General Engineering Science (German program): Specialis	sation Mechanica	I Engineering, Focus Theoretical	Mechanical Engin	eering: Compulsory
	General Engineering Science (German program): Specialis	sation Naval Arch	itecture: Compulsory		
	General Engineering Science (German program, 7 semeste	er): Specialisation	n Electrical Engineering: Compul	sory	
	General Engineering Science (German program, 7 semeste	er): Specialisation	n Mechanical Engineering, Focus	Mechatronics: Co	mpulsory
	General Engineering Science (German program, 7 seme	ester): Specialisa	tion Mechanical Engineering, F	ocus Theoretical I	Mechanical Engineering
	Compulsory				
	General Engineering Science (German program, 7 semeste	er): Specialisation	n Naval Architecture: Compulsory	′	
	Computer Science: Specialisation Computational Mathematic	atics: Elective Co	mpulsory		
	Electrical Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisa	ation Electrical E	ngineering: Compulsory		
	General Engineering Science (English program): Specialisa	ation Naval Arch	tecture: Compulsory		
	General Engineering Science (English program): Specialisa	ation Mechanica	Engineering, Focus Mechatronic	s: Compulsory	
	General Engineering Science (English program): Specialisa	ation Mechanica	Engineering, Focus Theoretical	Mechanical Engine	eering: Compulsory
	General Engineering Science (English program, 7 semester	er): Specialisation	Electrical Engineering: Compuls	sory	
	General Engineering Science (English program, 7 semester		-		
	General Engineering Science (English program, 7 seme	ester): Specialisa	tion Mechanical Engineering, F	ocus Theoretical I	Mechanical Engineering
	Compulsory				
	General Engineering Science (English program, 7 semester	er): Specialisation	Naval Architecture: Compulsory		
	Computational Science and Engineering: Specialisation En	ngineering Scien	ces: Elective Compulsory		
	Computational Science and Engineering: Specialisation Co				
	Mechanical Engineering: Specialisation Theoretical Mechanical Engineering: Compulsory				
Mechanical Engineering: Specialisation Mechatronics: Compulsory					
	Mechatronics: Core qualification: Compulsory				
	Naval Architecture: Core qualification: Compulsory				
	Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory				



Course L1043: Differential Equation	Course L1043: Differential Equations 2 (Partial Differential Equations)		
Тур	Lecture		
Hrs/wk	2		
CP	1		
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28		
Lecturer	Dozenten des Fachbereiches Mathematik der UHH		
Language	DE		
Cycle	SoSe		
Content	Main features of the theory and numerical treatment of partial differential equations		
	 Examples of partial differential equations First order quasilinear differential equations Normal forms of second order differential equations Harmonic functions and maximum principle Maximum principle for the heat equation Wave equation Liouville's formula Special functions Difference methods Finite elements 		
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html		

Course L1044: Differential Equations 2 (Partial Differential Equations)		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1045: Differential Equations 2 (Partial Differential Equations)	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1038: Complex Functions	
Тур	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	Main features of complex analysis
	Functions of one complex variable Complex differentiation Conformal mappings Complex integration Cauchy's integral theorem Cauchy's integral formula Taylor and Laurent series expansion Singularities and residuals Integral transformations: Fourier and Laplace transformation
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html



Course L1041: Complex Functions	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1042: Complex Functions	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



ourses	
itle	Typ Hrs/wk CP
troduction to Management (L0880)	Lecture 3 3
roject Entrepreneurship (L0882)	Problem-based Learning 2 3
Module Responsible	
Admission Requirements	None Regio Keguladas of Mathematics and Rusiness
Recommended Previous Knowledge	Basic Knowledge of Mathematics and Business
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After taking this module, students know the important basics of many different areas in Business and Management, from Planning and Organisation Marketing and Innovation, and also to Investment and Controlling. In particular they are able to
	 explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions from field of Management
	explain the most important aspects of and goals in Management and name the most important aspects of entreprneurial projects
	describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and hur
	ressource management, information management, innovation management and marketing
	explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives and uncertainty, and exp
	some basic methods from mathematical Finance
	state basics from accounting and costing and selected controlling methods.
Skills	Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry out Entrepreneurship project in a team. In particular, they are able to
	analyse Management goals and structure them appropriately
	analyse management goals and statistical appropriately analyse organisational and staff structures of companies
	apply methods for decision making under multiple objectives, under uncertainty and under risk
	analyse production and procurement systems and Business information systems
	analyse and apply basic methods of marketing
	select and apply basic methods from mathematical finance to predefined problems
	apply basic methods from accounting, costing and controlling to predefined problems
Personal Competence	
Social Competence	Students are able to
	work successfully in a team of students
	 to apply their knowledge from the lecture to an entrepreneurship project and write a coherent report on the project
	to communicate appropriately and
	to cooperate respectfully with their fellow students.
Autonomy	Students are able to
	work in a team and to organize the team themselves
	to write a report on their project.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	
Examination	Written exam
Examination duration and scale	90 minutes
Assignment for the Following	General Engineering Science (German program): Specialisation Electrical Engineering: Compulsory
Curricula	General Engineering Science (German program): Specialisation Computer Science: Compulsory
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

ompulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory

Electrical Engineering: Core qualification: Compulsory
Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program); Specialisation Energy and Environmental Engineering; Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program); Specialisation Process Engineering; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

 $\label{logistics} \textbf{Logistics and Mobility: Core qualification: Compulsory}$

 $\label{thm:mechanical engineering:Core qualification:Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Trees	Lastina		
Typ	Lecture		
Hrs/wk	3		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42		
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona		
Lammina	DE		
Language	WiSe/SoSe		
Cycle	WI26/2026		
Collen	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects 		
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008		
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003		
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.		
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.		
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.		
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.		
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.		

Course L0882: Project Entrepreneurship		
Тур	Problem-based Learning	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke	
Language	DE	
Cycle	WiSe/SoSe	
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,	
	using their knowledge from the corresponding lecture.	
	Project work is carried out in teams with the support of a mentor.	
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.	



Specialization Biomedical Engineering

The requirements into the health system increase continuously due to the aging population and the increasing expectations for the quality in life. A major aspect in this development is medical technology. This ranges from individual implants and prostheses to complex imaging and therapy equipment and its operation. Medical specialists and well educated engineers will have to cooperate closer and closer to understand the requirements from either side and develop solutions together. In order to cooperate, the engineers need in addition to their core engineering skills, a basic understanding of the "other" fields, which are Medicine and Economy. This enables them to understand operational planning as well as research and development in this highly interdisciplinary area. The program is aimed towards allowing the students to achieve these qualifications.

Module M0933: Fundament	als of Materials Science			
Courses				
Title		Тур	Hrs/wk	СР
Fundamentals of Materials Science I (L108	35)	Lecture	2	2
Fundamentals of Materials Science II (Adv	ranced Ceramic Materials, Polymers and Composites) (L0506)	Lecture	2	2
Physical and Chemical Basics of Materials		Lecture	2	2
Module Responsible	Prof. Jörg Weißmüller			
Admission Requirements	None			
Recommended Previous Knowledge	Highschool-level physics, chemistry und mathematics			
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	The students have acquired a fundamental knowledge on metals, ceramics and polymers and can describe this knowledge comprehensivel Fundamental knowledge here means specifically the issues of atomic structure, microstructure, phase diagrams, phase transformations, corrosion ar mechanical properties. The students know about the key aspects of characterization methods for materials and can identify relevant approaches for characterizing specific properties. They are able to trace materials phenomena back to the underlying physical and chemical laws of nature.			
Skills	The students are able to trace materials phenomena back to the underlying physical and chemical laws of nature. Materials phenomena here refers mechanical properties such as strength, ductility, and stiffness, chemical properties such as corrosion resistance, and to phase transformations such solidification, precipitation, or melting. The students can explain the relation between processing conditions and the materials microstructure, and the can account for the impact of microstructure on the material's behavior.			transformations such a
Personal Competence				
Social Competence	-			
Autonomy	-			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Energy and Environmental Engineeri	na: Compulsory	
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation		•	
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): Sp		g: Compulsory	
	General Engineering Science (German program, 7 semester): Sp	pecialisation Biomedical Engineering	g: Compulsory	
	General Engineering Science (German program, 7 semester): Sp	pecialisation Naval Architecture: Con	npulsory	
Į.	General Engineering Science (German program, 7 semester): Sp	and disease Consumer of Continuous	al Engineering: Compulsor	
i	denotal Engineering estence (demail program, 7 competer). of	becialisation Energy and Environment	3 3 1	/
	Energy and Environmental Engineering: Core qualification: Com		g g p	/
		pulsory		/
	Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	pulsory Energy and Enviromental Engineerin Mechanical Engineering: Compulso	ng: Compulsory	<i>(</i>
	Energy and Environmental Engineering: Core qualification: Corr General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	pulsory Energy and Enviromental Engineerin Mechanical Engineering: Compulsor Biomedical Engineering: Compulsor	ng: Compulsory	(
	Energy and Environmental Engineering: Core qualification: Corr General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	pulsory Energy and Enviromental Engineerii Mechanical Engineering: Compulsoi Biomedical Engineering: Compulsor Naval Architecture: Compulsory	ng: Compulsory ry y	(
	Energy and Environmental Engineering: Core qualification: Corr General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp	pulsory Energy and Enviromental Engineerii Mechanical Engineering: Compulsor Biomedical Engineering: Compulsor Naval Architecture: Compulsory ecialisation Mechanical Engineering	ng: Compulsory ry y r: Compulsory	,
	Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp	pulsory Energy and Enviromental Engineerir Mechanical Engineering: Compulsor Biomedical Engineering: Compulsor Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering	ng: Compulsory ry y g: Compulsory : Compulsory	,
	Energy and Environmental Engineering: Core qualification: Corn General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Specialisation General Engineering Science (English program)	pulsory Energy and Enviromental Engineerin Mechanical Engineering: Compulsor Biomedical Engineering: Compulsor Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Com	ng: Compulsory y y: Compulsory : Compulsory pulsory	
	Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Specialisation General Engineering Science (English program, 7 semester): Special Engineering Science (English program)	pulsory Energy and Enviromental Engineerir Mechanical Engineering: Compulsor Biomedical Engineering: Compulsor Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Com ecialisation Energy and Enviromenta	ng: Compulsory y y: Compulsory : Compulsory pulsory	
	Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Specialisation General Engineering Science (English program, 7 semester): Special Engineering Science (English program, 7 semester): Special Engineering Science (English program, 7 semester): Special Engineering Science (English program, 7 semester): Specialisation Engineering Science: Electric Specialisation Engineering Scie	pulsory Energy and Enviromental Engineerir Mechanical Engineering: Compulsor Biomedical Engineering: Compulsor Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Com ecialisation Energy and Enviromenta	ng: Compulsory y y: Compulsory : Compulsory pulsory	
	Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Specialisation General Engineering Science (English program, 7 semester): Specialisation Science (English program, 7 semester): Specialisation Engineering Science: Elect Mechanical Engineering: Core qualification: Compulsory	pulsory Energy and Enviromental Engineerir Mechanical Engineering: Compulsor Biomedical Engineering: Compulsor Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Com ecialisation Energy and Enviromenta	ng: Compulsory y y: Compulsory : Compulsory pulsory	
	Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Specialisation General Engineering Science (English program, 7 semester): Special Engineering Science (English program, 7 semester): Special Engineering Science (English program, 7 semester): Special Engineering Science (English program, 7 semester): Specialisation Engineering Science: Electric Specialisation Engineering Scie	pulsory Energy and Enviromental Engineerir Mechanical Engineering: Compulsor Biomedical Engineering: Compulsor Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Com ecialisation Energy and Enviromenta	ng: Compulsory y y: Compulsory : Compulsory pulsory	



Course L1085: Fundamentals of Ma	Course L1085: Fundamentals of Materials Science I		
Тур	Lecture		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Jörg Weißmüller		
Language	DE		
Cycle	WiSe		
Content			
Literature	Vorlesungsskript		
	W.D. Callister: Materials Science and Engineering - An Introduction. 5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7		

Course L0506: Fundamentals of Materials Science II (Advanced Ceramic Materials, Polymers and Composites)			
Тур	Lecture		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Bodo Fiedler, Prof. Gerold Schneider		
Language	DE		
Cycle	SoSe		
Content	Chemische Bindungen und Aufbau von Festkörpern; Kristallaufbau; Werkstoffprüfung; Schweißbarkeit; Herstellung von Keramiken; Aufbau und		
	Eigenschaften der Keramik; Herstellung, Aufbau und Eigenschaften von Gläsern; Polymerwerkstoffe, Makromolekularer Aufbau; Struktur und		
	Eigenschaften der Polymere; Polymerverarbeitung; Verbundwerkstoffe		
Literature	Vorlesungsskript		
	W.D. Callister: Materials Science and Engineering -An Introduction-5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7		

Course L1095: Physical and Chemic	cal Basics of Materials Science
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Müller
Language	DE
Cycle	WiSe
Content	Motivation: "Atoms in Mechanical Engineering?" Basics: Force and Energy The electromagnetic Interaction "Detour": Mathematics (complex e-funktion etc.) The atom: Bohr's model of the atom Chemical bounds The multi part problem: Solutions and strategies Descriptions of using statistical thermodynamics Elastic theory of atoms Consequences of atomar properties on makroskopic Properties: Discussion of examples (metals, semiconductors, hybrid systems)
Literature	Für den Elektromagnetismus: Bergmann-Schäfer: "Lehrbuch der Experimentalphysik", Band 2: "Elektromagnetismus", de Gruyter Für die Atomphysik: Haken, Wolf: "Atom- und Quantenphysik", Springer Für die Materialphysik und Elastizität: Hornbogen, Warlimont: "Metallkunde", Springer



Courses		
Title	Typ Hrs/wk CP	
Computer Engineering (L0321) Computer Engineering (L0324)	Lecture 3 4 Recitation Section (small) 1 2	
Module Responsible		
Admission Requirements		
Recommended Previous		
Knowledge		
	The successful completion of the labs will be honored during the evaluation of the module's examination according to the following rules:	
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the successful labs, such	that t
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.	
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge		down
Tillowicago	gates. The module includes the following topics:	down
	galoci ino inocato ino tono ini gi opioci	
	Introduction	
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks	
	Sequential logic: Flip-flops, automata, systematic hardware design The local d	
	Technological foundations Computer arithmetic: Integer addition, subtraction, multiplication and division	
	Computer arithmetic: Integer addition, subtraction, multiplication and division Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining	
	Memories: Memory hierarchies, SRAM, DRAM, caches	
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the physical composition	
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a collection of few an	nd sim
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing systems - from gates an	id circi
	up to complete processors.	
	After successful completion of the module, the students are able to judge the interdependencies between a physical computer system and the	softwa
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-centric abstraction la	yers fr
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels have on an entire	syste
	performance and to propose feasible options.	
Davasasi Cammatanas		
Personal Competence		
Social Competence		
	Students are able to solve similar problems alone or in a group and to present the results accordingly.	
Social Competence Autonomy	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.	
Social Competence Autonomy Workload in Hours	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56	
Social Competence Autonomy Workload in Hours Credit points	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6	
Social Competence Autonomy Workload in Hours Credit points Examination	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	mpulsc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory	Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanroics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus	Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisa	Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Computsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation	Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanicis: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development a	Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Domputer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Divil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatrolas in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Metarials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Metarials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Special	Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Divid Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Engineering Science	Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Divide Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and	Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Aval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Methatials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engomering Science (German program, 7 semester): Specialisation Mechanical Engineerin	Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Diagnosis (Compulsory) General Engineering Science (German program, 7 semester): Specialisation Simmedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Prompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Prompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering,	Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program): Pore qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Programisory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General	Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Diagnosis (Compulsory) General Engineering Science (German program, 7 semester): Specialisation Simmedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Prompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Prompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering,	Scienc

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Computational Science and Engineering: Core qualification: Compulsory
Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	ng	
Тур	ture	
Hrs/wk		
CP	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Heiko Falk	
Language	DE	
Cycle	WiSe	
Content	Introduction Combinational Logic Sequential Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output	
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005. 	

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0680: Fluid Dynar	nics			
0				
Courses				
Title		Тур	Hrs/wk	CP
Fluid Mechanics (L0454) Fluid Mechanics (L0455)		Lecture Recitation Section (large)	3	4
Module Responsible	Prof. Thomas Rung	Heditation dection (large)	2	2
Admission Requirements	•			
	none Sound knowledge of engineering methomatics, engineering make	vanios and thermodynamics		
Recommended Previous Knowledge	Sound knowledge of engineering mathematics, engineering mech	ianics and inermodynamics.		
0	After taking part auggestafully at idente have reached the following	loorning roculto		
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence	Or death will be a like and to death and to be a late.		and a boundary of flooding of	New Janets and the Property of
Knowledge	Students will have the required sound knowledge to explain the			•
	outline the rationale of flow physics using mathematical models	and are familiar with methods for the pe	errormance analysis a	and the prediction of fluid
	engineering devices.			
Skills	Students are able to apply fluid-engineering principles and flow-p	hysics models for the analysis of technic	cal systems. The lectu	re enables the student to
	carry out all necessary theoretical calculations for the fluid dynamic	c design of engineering devices on a sc	ientific level.	
Personal Competence				
Social Competence	The students are able to discuss problems and jointly develop sol	ution strategies.		
Autonomy	The students are able to develop solution strategies for complex p	roblems self-consistent and crtically ana	lyse results.	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation I	Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation B	Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation I			
	General Engineering Science (German program, 7 semester): Spe	ecialisation Mechanical Engineering: Co	mpulsory	
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): Spe	·	ory	
	General Engineering Science (English program): Specialisation M			
	General Engineering Science (English program): Specialisation E			
	General Engineering Science (English program): Specialisation N			
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe		ory	
	Computational Science and Engineering: Specialisation Engineer	ring Sciences: Elective Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory	tive Communication		
	Technomathematics: Specialisation III. Engineering Science: Elec	uve Compulsory		

Course L0454: Fluid Mechanics		
Тур	ecture	
Hrs/wk		
CP		
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Thomas Rung	
Language	DE	
Cycle	SoSe	
Content	Overview Physical/mathematical modelling Special phenomena Basic equations of fluid dynamics The turbulence problem One dimensional theory for inkompressibel flows One dimensional theory for kompressibel flows Flow over contours without friction Flow over contours with friction Flow through channels Simplified equations for three dimensional flow Special aspects of the numerical solution for complex flows	
Literature	 Herwig, H.: Strömungsmechanik, 2. Auflage, Springer- Verlag, Berlin, Heidelberg, 2006 Herwig, H.: Strömungsmechanik von A-Z, Vieweg Verlag, Wiesbaden, 2004 	



Course L0455: Fluid Mechanics	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Thomas Rung
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



ourses				
tle		Тур	Hrs/wk	СР
gnals and Systems (L0432)		Lecture	3	4
gnals and Systems (L0433)		Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch			
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge	The modul is an introduction to the theory of signals and s	vetame. Good knowledge in mathe as covere	d by the module Mat	homatik 1 2 is ovnos
	Further experience with spectral transformations (Fourier ser			
Educational Objectives	After taking part successfully, students have reached the following	owing learning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and li	near time-invariant (LTI) systems using metho	ods of signal and syste	em theory. They are a
	to apply the fundamental transformations of continuous-time $% \label{eq:continuous} % eq:cont$	and discrete-time signals and systems. They	can describe and anal	yse deterministic sig
	and systems mathematically in both time and image doma	in. In particular, they understand the effects	in time domain and in	mage domain which
	caused by the transition of a continuous-time signal to a disc	rete-time signal.		
Skills	The students are able to describe and analyse deterministic	signals and linear time-invariant systems usi	ng methods of signal	and system theory. T
	can analyse and design basic systems regarding important	properties such as magnitude and phase res	ponse, stability, linear	ity etc They can ass
	the impact of LTI systems on the signal properties in time and	frequency domain.		
Personal Competence				
Social Competence	The students can jointly solve specific problems.			
Autonomy	The students are able to acquire relevant information from	appropriate literature sources. They can cont	rol their level of know	ledge during the led
	period by solving tutorial problems, software tools, clicker sys	stem.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program): Specialisa	tion Process Engineering: Compulsory		
	General Engineering Science (German program): Specialisa	tion Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisa	tion Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (German program): Specialisa	tion Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisa	tion Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Comp	oulsory	
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compuls	ory	
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compu	ulsory	
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Cor	mpulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foo	cus Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foo	cus Energy Systems: 0	Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foo	cus Aircraft Systems E	ngineering: Compuls
	General Engineering Science (German program, 7 seme	ster): Specialisation Mechanical Engineering	g, Focus Materials in	Engineering Scien
	Compulsory			
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foo	cus Mechatronics: Cor	npulsory
	General Engineering Science (German program, 7 semes	ter): Specialisation Mechanical Engineering	, Focus Theoretical M	Mechanical Engineer
	Compulsory			
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisat	tion Civil- and Enviromental Engeneering: Cor	mpulsory	
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program, 7 semester)		•	
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			moulcory
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semes	sier). Specialisation Mechanical Engineering	y, rocus Materials in	Engineering Scien
	Compulsory General Engineering Science (English program 7 semester)	Specialization Machanical Engineering For	us Machatranias C	nuleon/
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semes	iei). opecialisation iviechanical Engineering.	, rocus meoretical N	nechanicai Engineei
	Compulsory Computational Science and Engineering: Core qualification:	Compulario		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	s
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle Content	Basic classification and description of continuous-time and discrete-time signals and systems
	Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)
	Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

Course L0433: Signals and Systems	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Courses				
Title		Тур	Hrs/wk	СР
Mechanics IV (Kinetics II, Oscillations, An	alytical Mechanics, Multibody Systems) (L1137)	Lecture	3	3
	alytical Mechanics, Multibody Systems) (L1138)	Recitation Section (small)	2	2
	alytical Mechanics, Multibody Systems) (L1139)	Recitation Section (large)	1	1
Module Responsible	Prof. Robert Seifried			
Admission Requirements	none			
Recommended Previous	Mathematics I-III and Mechanics I-III			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	wing learning results		
Professional Competence				
Knowledge	The students can			
	describe the axiomatic precedure used in mechanica	contexts:		
	 describe the axiomatic procedure used in mechanica explain important steps in model design; 	oonone,		
	 present technical knowledge. 			
	- present teeningar knowledge.			
Skills	The students can			
	ovaloin the important elements of methematical / mag	agained analysis and model formation, and an	alv it to the contact of	their own problems:
	 explain the important elements of mathematical / med apply basic methods to engineering problems; 	namical analysis and model formation, and ap	pry it to the context or	their own problems,
	 estimate the reach and boundaries of the methods ar 	d extend them to be applicable to wider proble	am eate	
	esumate the reach and boundaries of the methods at	d exterio trieffi to be applicable to wider proble	5111 5015.	
D				
Personal Competence	The state of the s	er e		
Social Competence	The students can work in groups and support each other to o	vercome difficulties.		
Autonomy	Students are capable of determining their own strengths and	weaknesses and to organize their time and le	arning based on thos	se.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisa	tion Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program, 7 semester			
	General Engineering Science (German program, 7 semester			
	General Engineering Science (German program, 7 semester		ory	
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program): Specialisat	• •		
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)	Specialisation Naval Architecture: Compulso	ry	
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory	Elective Compulsory		
	Technomathematics: Specialisation III. Engineering Science:			
	Technomathematics: Core qualification: Elective Compulsory			

Course L1137: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Lecture	
Hrs/wk	3	
CP	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	- Simple impact problems	
	- Principles of analytical mechanics	
	- Elements of vibration theory	
	- Vibration of Multi-degree of freedom systems	
	- Multibody Systems	
Literature	K. Magnus, H.H. Müller-Slany: Grundlagen der Technischen Mechanik. 7. Auflage, Teubner (2009).	
	D. Gross, W. Hauger, J. Schröder, W. Wall: Technische Mechanik 1-4. 11. Auflage, Springer (2011).	
	W. Schiehlen, P. Eberhard: Technische Dynamik, Springer (2012).	



Course L1138: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1277: MED I: Intro	oduction to Anatomy
Courses	
Title	Typ Hrs/wk CP
Introduction to Anatomy (L0384)	Lecture 2 3
Module Responsible	Prof. Udo Schumacher
Admission Requirements	None
Recommended Previous	None
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The students can describe basal structures and functions of internal organs and the musculoskeletal system.
	The students can describe the basic macroscopy and microscopy of those systems.
Skills	The students can recognize the relationship between given anatomical facts and the development of some common diseases; they can explain the
Ollino	relevance of structures and their functions in the context of widespread diseases.
Personal Competence	
Social Competence	The students can participate in current discussions in biomedical research and medicine on a professional level.
Autonomy	The students are able to access anatomical knowledge by themselves, can participate in conversations on the topic and acquire the relevant knowledge
	themselves.
Workload in Hours	Independent Ctudy Time CO. Ctudy Time in Leature 20
Credit points	
Examination	Written exam
Examination duration and scale	90 minutes
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Curricula	
Carricala	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	Electrical Engineering: Specialisation Medical Technology: Elective Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	Mechanical Engineering: Specialisation Biomechanics: Compulsory
	Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory
	Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory
	Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory
	Diemodical Engineering openialization rational organic and negoticitative medicine Elective company
	Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory



Course L0384: Introduction to Anato	omy	
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Tobias Lange	
Language	DE .	
Cycle	SoSe General Anatomy	
Content	1 st week: The Eucaryote Cell	
	2 nd week: The Tissues 3 rd week: Cell Cycle, Basics in Development	
	4 th week: Musculoskeletal System	
	5 th week: Cardiovascular System	
	6 th week: Respiratory System	
	7 th week: Genito-urinary System	
	8 th week: Immune system	
	9 th week: Digestive System I	
	10 th week: Digestive System II	
	11 th week: Endocrine System	
	12 th week: Nervous System	
	13 th week: Exam	
Literature	Adolf Faller/Michael Schünke, Der Körper des Menschen, 16. Auflage, Thieme Verlag Stuttgart, 2012	



Module M1278: MED I: Intro	oduction to Radiology and Radiation Therapy
^oureoo	
ourses	Typ Hrs/wk CP
troduction to Radiology and Radiation TI	· ·
Module Responsible	
Admission Requirements	None
Recommended Previous	None
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	
	The students can distinguish different types of currently used equipment with respect to its use in radiation therapy.
	The students can explain treatment plans used in radiation therapy in interdisciplinary contexts (e.g. surgery, internal medicine).
	The students can describe the patients' passage from their initial admittance through to follow-up care.
	Diagnostics
	Diagnostics
	The students can illustrate the technical base concepts of projection radiography, including angiography and mammography, as well as section imaging techniques (CT, MRT, US).
	The students can explain the diagnostic as well as therapeutic use of imaging techniques, as well as the technical basis for those techniques.
	The students can choose the right treatment method depending on the patient's clinical history and needs.
	The student can explain the influence of technical errors on the imaging techniques.
	The student can draw the right conclusions based on the images' diagnostic findings or the error protocol.
Skills	Therapy
	The students can distinguish curative and palliative situations and motivate why they came to that conclusion.
	The students can develop adequate therapy concepts and relate it to the radiation biological aspects.
	The students can use the therapeutic principle (effects vs adverse effects)
	The students can distinguish different kinds of radiation, can choose the best one depending on the situation (location of the tumor) and choose energy needed in that situation (irradiation planning).
	The student can assess what an individual psychosocial service should look like (e.g. follow-up treatment, sports, social help groups, self-help groups social services, psycho-oncology).
	Diagnostics
	The students can suggest solutions for repairs of imaging instrumentation after having done error analyses.
	The students can classify results of imaging techniques according to different groups of diseases based on their knowledge of anatomy, pathology a pathophysiology.
Personal Competence	
Social Competence	The students can assess the special social situation of tumor patients and interact with them in a professional way.
	The students are aware of the special, often fear-dominated behavior of sick people caused by diagnostic and therapeutic measures and can meet the
	appropriately.
Autonomy	The students can apply their new knowledge and skills to a concrete therapy case.
	The students can introduce younger students to the clinical daily routine.
	The students are able to access anatomical knowledge by themselves, can participate competently in conversations on the topic and acquire
	relevant knowledge themselves.
Workload in Hours	
Credit points	
Examination Examination duration and scale	
Assignment for the Following	
Curricula	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	Electrical Engineering: Specialisation Medical Technology: Elective Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory General Engineering Science (English program 7 semester): Specialisation Mechanical Engineering Focus Biomechanics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	Mechanical Engineering: Specialisation Biomechanics: Compulsory
	Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory
	Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory
	Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory
	Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory



Course L0383: Introduction to Radio	ology and Radiation Therapy
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	
Lecturer Language	, ,
Cycle	
Content	The students will be given an understanding of the technological possibilities in the field of medical imaging, interventional radiology and radiation therapy/radiation oncology. It is assumed, that students in the beginning of the course have heard the word "X-ray" at best. It will be distinguished between the two arms of diagnostic (Prof. Dr. med. Thomas Vestring) and therapeutic (Prof. Dr. med. Ulrich Carl) use of X-rays. Both arms depend on special big units, which determine a predefined sequence in their respective departments
Literature	"Technik der medizinischen Radiologie" von T. + J. Laubenberg –
	7. Auflage – Deutscher Ärzteverlag – erschienen 1999
	"Klinische Strahlenbiologie" von Th. Herrmann, M. Baumann und W. Dörr –
	4. Auflage - Verlag Urban & Fischer – erschienen 02.03.2006
	ISBN: 978-3-437-23960-1
	"Strahlentherapie und Onkologie für MTA-R" von R. Sauer –
	5. Auflage 2003 - Verlag Urban & Schwarzenberg – erschienen 08.12.2009
	ISBN: 978-3-437-47501-6
	"Taschenatlas der Physiologie" von S. Silbernagel und A. Despopoulus
	8. Auflage – Georg Thieme Verlag - erschienen 19.09.2012
	ISBN: 978-3-13-567708-8
	"Der Körper des Menschen " von A. Faller u. M. Schünke -
	16. Auflage 2004 - Georg Thieme Verlag - erschienen 18.07.2012
	ISBN: 978-3-13-329716-5
	"Praxismanual Strahlentherapie" von Stöver / Feyer –
	1. Auflage - Springer-Verlag GmbH – erschienen 02.06.2000



Module M0596. Mechanical	Engineering: Design				
Courses					
Title		Тур	Hrs/wk	CP	
Embodiment Design and 3D-CAD (L0268)		Lecture	2	1	
Mechanical Design Project I (L0695)		Practical Course	3	2	
Mechanical Design Project II (L0592)		Practical Course	3	2	
Team Project Design Methodology (L0267	")	Problem-based Learning	2	1	
Module Responsible	Prof. Dieter Krause				
Admission Requirements	None				
Recommended Previous	Fundamentals of Mechanical Engineering Design				
Knowledge	Mechanics Mechanics				
	Fundamentals of Materials Science				
	Production Engineering				
	Troduction Engineering				
Educational Objectives	After taking part successfully, students have reached the following	wing learning results			
Professional Competence					
Knowledge	After passing the module, students are able to:				
	explain design guidelines for machinery parts e.g. cor	nsidering load situation, materials and manu	facturing requirements	,	
	describe basics of 3D CAD,				
	 explain basics methods of engineering designing. 				
Skills	After passing the module, students are able to:				
	• independently greats alcotobae technical drawings are	ad decumentations of a using 2D CAD			
	independently create sketches, technical drawings and documentations e.g. using 3D CAD, design components based on design guidelines cuton mounts.				
	design components based on design guidelines autonomously, dimension (calculate) used components				
	 dimension (calculate) used components, use methods to design and solve engineering design tasks systamtically and solution-oriented, 				
	 apply creativity techniques in teams. 				
	apply dealivity techniques in teams.				
Personal Competence					
Social Competence	After passing the module, students are able to:				
	decide and analysis of the section o	alternation and decrease with a decrease			
	develop and evaluate solutions in groups including m	aking and documenting decisions,			
	moderate the use of scientific methods,	with in the control of the control o			
	 present and discuss solutions and technical drawings reflect the own results in the work groups of the cours 				
	 reflect the own results in the work groups of the cours 	5 .			
Autonomy	Students are able				
	to estimate their level of knowledge using activating	methods within the lectures (e.g. with clicker	'S),		
	 To solve engineering design tasks systematically. 				
Workload in Hours	Independent Study Time 40, Study Time in Lecture 140				
Credit points	6				
Examination	Written exam				
Examination duration and scale	180				
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Energy and Environmental Engineering:	Compulsory		
Curricula	General Engineering Science (German program): Specialisa		Compaisory		
0404.4	General Engineering Science (German program): Specialisa				
			ompulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory				
	Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory				
	General Engineering Science (English program): Specialisat	0,			
	General Engineering Science (English program): Specialisat				
	General Engineering Science (English program, 7 semester)		ompulsorv		
	General Engineering Science (English program, 7 semester)				
	General Engineering Science (English program, 7 semester)			v	
	Mechanical Engineering: Core qualification: Compulsory			,	
	Mechatronics: Core qualification: Compulsory				



Course L0268: Embodiment Design	and 3D-CAD
Тур	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause
Language	DE
Cycle	WiSe
Content	Basics of 3D CAD technology Practical course to apply a 3D CAD system Introduction to the system Sketching and creation of components Creation of assemblies Deriving technical drawings
Literature	 CAx für Ingenieure eine praxisbezogene Einführung; Vajna, S., Weber, C., Bley, H., Zeman, K.; Springer-Verlag, aktuelle Auflage. Handbuch Konstruktion; Rieg, F., Steinhilper, R.; Hanser; aktuelle Auflage. Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Technisches Zeichnen: Grundlagen, Normen, Beispiele, Darstellende Geometrie, Hoischen, H; Hesser, W; Cornelsen, aktuelle Auflage. Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage. Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.

Course L0695: Mechanical Design F	Project I
Тур	Practical Course
Hrs/wk	3
CP	2
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42
Lecturer	Prof. Thorsten Schüppstuhl
Language	DE
Cycle	WiSe
Content	Create a technical documentation of an existing mechanical model Consolidation of the following aspects of technical drawings: Presentation of technical objects and standardized parts (bearings, seals, shaft-hub joints, detachable connections, springs, axes and shafts) Sectional views Dimensioning Tolerances and surface specifications Creating a tally sheet
Literature	 Hoischen, H.; Hesser, W.: Technisches Zeichnen. Grundlagen, Normen, Beispiele, darstellende Geometrie, 33. Auflage. Berlin 2011. Labisch, S.; Weber, C.: Technisches Zeichnen. Selbstständig lernen und effektiv üben, 4. Auflage. Wiesbaden 2008. Fischer, U.: Tabellenbuch Metall, 43. Auflage. Haan-Gruiten 2005.



Course L0592: Mechanical Design Project II		
Тур	Practical Course	
Hrs/wk	3	
CP	2	
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42	
Lecturer	Prof. Wolfgang Hintze	
Language	DE	
Cycle	SoSe	
Content	Generation of sketches for functions and sub-functions Approximately calculation of shafts Dimension of bearings, screw connections and weld Generation of engineering drawings (assembly drawings, manufacturing drawing)	
Literature	Dubbel, Taschenbuch für Maschinenbau, Beitz, W., Küttner, KH, Springer-Verlag. Maschinenelemente, Band I - III, Niemann, G., Springer-Verlag. Maschinen- und Konstruktionselemente, Steinhilper, W., Röper, R., Springer-Verlag. Einführung in die DIN-Normen, Klein, M., Teubner-Verlag. Konstruktionslehre, Pahl, G., Beitz, W., Springer-Verlag.	

Course L0267: Team Project Design	n Methodology
Тур	Problem-based Learning
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause
Language	DE
Cycle	SoSe
Content	Introduction to engineering designing methodology Team Project Design Methodology Creating requirement lists Problem formulation Creating functional structures Finding solutions Evaluation of the found concepts Documentation of the taken methodological steps and the concepts using presentation slides
Literature	 Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage. Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage. Sowie weitere Bücher zu speziellen Themen



ourses				
tle		Тур	Hrs/wk	CP
umerical Mathematics I (L0417) umerical Mathematics I (L0418)		Lecture Recitation Section (small)	2	3
	Prof. Sabine Le Borne	necitation Section (smail)	2	3
Module Responsible				
Admission Requirements	None			
Recommended Previous Knowledge	Mathematik I + II for Engineering Students (german or engli basic MATLAB knowledge	sh) or Analysis & Linear Algebra I + II fo	Technomathematici	ans
Educational Objectives	After taking part successfully, students have reached the following	earning results		
Professional Competence				
Knowledge	Students are able to			
	 name numerical methods for interpolation, integration, lea explain their core ideas, repeat convergence statements for the numerical methods, explain aspects for the practical execution of numerical methods. 			finding problems and
Skills	Students are able to			
	 implement, apply and compare numerical methods using MATLAB, justify the convergence behaviour of numerical methods with respect to the problem and solution algorithm, select and execute a suitable solution approach for a given problem. 			
Personal Competence Social Competence	Students are able to			
	 work together in heterogeneously composed teams (i.e., to foundations and support each other with practical aspects re 			edge), explain theoret
Autonomy	Students are capable			
	to assess whether the supporting theoretical and practical e to assess their individual progess and, if necessary, to ask or		or in a team,	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation C	omputor Science: Compulsory		
Curricula	General Engineering Science (German program): Specialisation of		anice: Compulsory	
Curricula	General Engineering Science (German program): Specialisation M			nces: Compulsory
	General Engineering Science (German program): Specialisation B		in Engineering ocie	nces. Compaisory
	General Engineering Science (German program, 7 semester): Spe		arv	
	General Engineering Science (German program, 7 semester):	·	•	n Engineering Scienc
	Compulsory	spooranoaton moonamea Engineering	,, roodo matemato n	. Linginiouring colonic
	General Engineering Science (German program, 7 semester): Spe	cialisation Biomedical Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester): Spe			ompulsory
	Bioprocess Engineering: Specialisation A - General Bioprocess En	gineering: Elective Compulsory		
	Computer Science: Specialisation Computational Mathematics: Ele	ective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program): Specialisation Co	omputer Science: Compulsory		
	General Engineering Science (English program): Specialisation Bi	omedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Me	echanical Engineering, Focus Biomecha	anics: Compulsory	
	General Engineering Science (English program): Specialisation Me	echanical Engineering, Focus Materials	in Engineering Scier	ices: Compulsory
	General Engineering Science (English program, 7 semester): Spec	ialisation Computer Science: Compulso	ory	
	General Engineering Science (English program, 7 semester): S Compulsory	Specialisation Mechanical Engineering	, Focus Materials in	n Engineering Science
	General Engineering Science (English program, 7 semester): Spec	ialisation Biomedical Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester): Spec	ialisation Mechanical Engineering, Foc	us Biomechanics: Co	mpulsory
	Computational Science and Engineering: Core qualification: Comp	ulsory		
	Process Engineering: Specialisation Process Engineering: Elective	Compulacry		



Course L0417: Numerical Mathema	tics I
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Sabine Le Borne, Dr. Patricio Farrell
Language	DE/EN
Cycle	WiSe
Content	 Error analysis: Number representation, error types, conditioning and stability Interpolation: polynomial and spline interpolation Numerical integration and differentiation: order, Newton-Cotes formula, error estimates, Gaussian quadrature, adaptive quadrature, difference formulas Linear systems: LU and Cholesky factorization, matrix norms, conditioning Linear least squares problems: normal equations, Gram.Schmidt and Householder orthogonalization, singular value decomposition, regularization Eigenvalue problems: power iteration, inverse iteration, QR algorithm Nonlinear systems of equations: Fixed point iteration, root-finding algorithms for real-valued functions, Newton and Quasi-Newton methods for systems
Literature	Stoer/Bulirsch: Numerische Mathematik 1, Springer Dahmen, Reusken: Numerik für Ingenieure und Naturwissenschaftler, Springer

course L0418: Numerical Mathematics I			
Тур	Recitation Section (small)		
Hrs/wk	2		
СР	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Sabine Le Borne, Dr. Patricio Farrell		
Language	DE/EN		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		



Module M0684: Heat Transf	fer			
Courses				
Title		Tun	Hro hule	CP
		Тур	Hrs/wk 3	
Heat Transfer (L0458) Heat Transfer (L0459)		Lecture Recitation Section (large)	2	4 2
Module Responsible	Dr. Andreas Moschallski	riecitation dection (large)	2	2
Admission Requirements	none			
Recommended Previous	Technical Thermodynamics I, II and Fluid Dynamics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following I	earning results		
Professional Competence				
Knowledge	The students are able to			
	- describe the different physical mechanism of Heat Transfer,			
	- explain the technical terms,			
	- to analyse comlex heat transfer processes in a critical way.			
Skills	The students are able to			
	- understand the physics of Heat Transfer,			
	- calculate and evaluate complex Heat Transfer processes,			
	- solve excersises self-consistent and in small groups.			
Personal Competence				
Social Competence	The students are able to discuss in small groups and develop an approximation of the students are able to discuss in small groups and develop an approximation of the students are able to discuss in small groups and develop an approximation of the students are able to discuss in small groups and develop an approximation of the students are able to discuss in small groups and develop an approximation of the students are able to discuss in small groups and develop an approximation of the students are able to discuss in small groups and develop an approximation of the students are able to discuss in small groups and develop an approximation of the students are able to discuss and develop an approximation of the students are also as a student and a students are al	proach.		
Autonomy	The students are able to develop a complex problem self-consister	t and analyse the results in a critical wa	ay. A qualified exchan	ge with other students is
,	given.	,		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Me			
Curricula	General Engineering Science (German program): Specialisation Me		ystems: Compulsory	
	General Engineering Science (German program): Specialisation Bi			
	General Engineering Science (German program): Specialisation Me			
	General Engineering Science (German program, 7 semester): Spec			
	General Engineering Science (German program, 7 semester): S	pecialisation Mechanical Engineering,	Focus Ineoretical N	iecnanicai Engineering:
	Compulsory	introduce Biomedical English of the Oct	and the same	
	General Engineering Science (German program, 7 semester): Spec		ipuisory	
	General Engineering Science (English program): Specialisation Bio		-i O I	
	General Engineering Science (English program): Specialisation Me			
	General Engineering Science (English program): Specialisation Me			oring: Compulsors
	General Engineering Science (English program): Specialisation Me			
	General Engineering Science (English program, 7 semester): Spec General Engineering Science (English program, 7 semester): Spec	-		
	Compulsory	occiansanon wechanical Engineering,	rocus meoretical IV	echanicai Engineering:
	General Engineering Science (English program, 7 semester): Spec	alisation Biomedical Engineering: Com	pulsory	
	Mechanical Engineering: Specialisation Energy Systems: Compuls			
	Mechanical Engineering: Specialisation Theoretical Mechanical En	gineering: Compulsory		

Course L0458: Heat Transfer	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Dr. Andreas Moschallski
Language	DE
Cycle	WiSe
Content	Dimensional analysis, heat conduction, convective heat transfer, Two-phase heat transfer (evaporation, condensation), thermal radiation, heat exchangers, measurement methods
Literature	 Herwig, H.; Moschallski, A.: Wärmeübertragung, 3. Auflage, Springer Vieweg Verlag, Wiesbaden, 2014 Herwig, H.: Wärmeübertragung von A-Z, Springer- Verlag, Berlin, Heidelberg, 2000 Baehr, H.D.; Stephan, K.: Wärme- und Stoffübertragung, 2. Auflage, Springer Verlag, Berlin, Heidelberg, 1996



Course L0459: Heat Transfer		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Andreas Moschallski	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0956: Measureme	ent Technology for Mechanical and Process E	Engineers			
Courses					
Title		Тур	Hrs/wk	СР	
Practical Course: Measurement and Control Systems (L1119)		Laboratory Course	2	2	
Measurement Technology for Mechanical	and Process Engineers (L1116)	Lecture	2	3	
Measurement Technology for Mechanical	and Process Engineers (L1118)	Recitation Section (large)	1	1	
Module Responsible	Dr. Sven Krause				
Admission Requirements	none				
Recommended Previous	Basic knowledge of physics, chemistry and electrical enginee	ring			
Knowledge					
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results			
Professional Competence					
Knowledge	Students are able to name the most important fundmentals of	of the Measurement Technology (Quantities	and Units, Uncertainty	, Calibration, Static ar	
	Dynamic Properties of Sensors and Systems).				
	They can outline the most important measuring methods for o	different kinds of quantities to be maesured (Electrical Quantities.	Temperature, mechanic	
	quantities, Flow, Time, Frequency).				
	They can describe important methods of chemical Analysis (G	Gas Sensors, Spectroscopy, Gas Chromatogr	aphy)		
Skills	Students can select suitable measuring methods to given pro-	blems and can use refering measurement de	vices in practice.		
	The students are able to orally explain issues in the subject area of measurement technology and solution approaches as well as place the issues in				
	the right context and application area.	area of measurement technology and solution	лі арріоаспез аз жеі	i as place the issues in	
	are ngm comon and approximation area.				
Personal Competence					
Social Competence	Students can arrive at work results in groups and document the	nem in a common report.			
Autonomy	Students are able to familiarize themselves with new measure	ement technologies.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70				
Credit points	6				
Examination	Written exam				
Examination duration and scale	105 minutes				
Assignment for the Following	General Engineering Science (German program): Specialisat	ion Energy and Environmental Engineering: (Compulsory		
Curricula	General Engineering Science (German program): Specialisat		ompulsory		
Garriodia	General Engineering Science (German program): Specialisat				
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Bechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory				
	General Engineering Science (German program, 7 semester)				
	General Engineering Science (German program, 7 semester)				
	Energy and Environmental Engineering: Core qualification: C		-		
	General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (English program, 7 semester):	Specialisation Process Engineering: Compu	ılsory		
	Mechanical Engineering: Core qualification: Compulsory				
	Mechatronics: Core qualification: Compulsory				
	Process Engineering: Core qualification: Compulsory				



Тур	Laboratory Course
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Wolfgang Schröder
Language	DE
Cycle	WiSe/SoSe
Content	Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutar
	automotive exhaust are used.
	Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated
	starting will be simulated on a PC and compared with measurement.
	Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michelson interferometer and fiber optic:
	interferometer and optical fibers demonstrated.
	Experiment 4:Identification of the parameters of a control system and optimal control parameters
Literature	Versuch 1:
	Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaf W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaf W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaf W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaf W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaf W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaf W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaf W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaf W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaf W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaf W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaft und ihrer Verunreinigung in der freien Atmosphäre und ihrer Verun
	Verlagsgesellschaft, Stuttgart, 1974
	 Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, Mün Wien, 1979
	 Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung
	Gebrauchs- und Bedienungsanweisungen
	VDI-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 Bl.1, 2451 Bl.4, 2453 Bl.5, 2455 Bl.1
	Versuch 2:
	Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren
	Simulationsmethoden, speziell: Verwendung von Blockschaltbildern
	Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze
	Versuch 3:
	Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984
	 Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1988
	Culshaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989
	Versuch 4:
	Loophard: Finführung in die Pagelungstachnik Viewag Vorlag, Praugschweig Mischaden
	Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden Jan Lunze: Systemtheoretische Grundlagen, Analyse und Entwurf einschleifiner Regelungen.
	 Jan Lunze: Systemtheoretische Grundlagen, Analyse und Entwurf einschleifiger Regelungen



Course L1116: Measurement Techn	nology for Mechanical and Process Engineers	
Тур	Lecture	
Hrs/wk	2	
СР		
Workload in Hours	dependent Study Time 62, Study Time in Lecture 28	
Lecturer	r. Sven Krause	
Language		
Cycle		
Content		
	1.1 Quantities and Units	
	1.2 Uncertainty	
	1.3 Calibration	
	1.4 Static and Dynamic Properties of Sensors and Systems	
	2 Measurement of Electrical Quantities	
	2.1 Current and Voltage	
	2.2 Impedance	
	2.3 Amplification	
	2.4 Oscilloscope	
	2.5 Analog-to-Digital Conversion	
	2.6 Data Transmission	
	3 Measurement of Nonelectric Quantities	
	3.1 Temperature	
	3.2 Length, Displacement, Angle	
	3.3 Strain, Force, Pressure	
	3.4 Flow	
	3.5 Time, Frequency	
	4 Chemical Analysis	
	4.1 Gas Sensors	
	4.2 Spectroscopy	
	4.3 Gas Chromatography	
	At the end of each lecture students present single measuring techniques and results orally in front of the class.	
Literature	Lerch, R.: "Elektrische Messtechnik; Analoge, digitale und computergestützte Verfahren", Springer, 2006, ISBN: 978-3-540-34055-3.	
	Profos, P. Pfeifer, T.: "Handbuch der industriellen Messtechnik", Oldenbourg, 2002, ISBN: 978-3486217940.	

Course L1118: Measurement Technology for Mechanical and Process Engineers	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Sven Krause
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses	
itle	Typ Hrs/wk CP Lecture 2 4
ntroduction to Control Systems (L0654) ntroduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2
Module Responsible	Prof. Herbert Werner
Admission Requirements	none
Recommended Previous	Representation of signals and systems in time and frequency domain, Laplace transform
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second.
	systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.
	They can explain the role of the phase margin in analysis and synthesis of control loops
	They can explain the way a PID controller affects a control loop in terms of its frequency response
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally
Skills	
30	Students can transform models of linear dynamic systems from time to frequency domain and vice versa
	They can simulate and assess the behavior of systems and control loops They can design RID control for with the balls of havington (7) relies Nichelly by its production.
	 They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
Personal Competence	
Social Competence	
Autonomy	
	problems.
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Workload in Hours Credit points	Independent Study Time 124, Study Time in Lecture 56
Credit points	6 Written exam
Credit points Examination	6 Written exam 120 min
Credit points Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compul General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compul General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German pro
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engine
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Com
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Divide Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compu
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering; Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productompulsory General Engineering: Core qualification: Compulsory General Engineering: Core qualification: Com
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Deman program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Scienc
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Elimentering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialis
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Domputer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program, 7 semester)
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Elimentering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialis



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Energy\ Systems:\ Compulsory$

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

urse L0654: Introduction to Conti		
Тур		
Hrs/wk	2	
СР	4	
Workload in Hours	ndependent Study Time 92, Study Time in Lecture 28	
Lecturer	Prof. Herbert Werner	
Language	DE	
Cycle	WiSe	
Content	Signals and systems • Linear systems, differential equations and transfer functions • First and second order systems, poles and zeros, impulse and step response • Stability	
	Feedback systems	
	Principle of feedback, open-loop versus closed-loop control Reference tracking and disturbance rejection	
	Types of feedback, PID control	
	System type and steady-state error, error constants	
	Internal model principle	
	Root locus techniques	
	Root locus plots	
	Root locus design of PID controllers	
	Frequency response techniques	
	Bode diagram Minimum and non-minimum phase systems Nyquist plot, Nyquist stability criterion, phase and gain margin Loop shaping, lead lag compensation Frequency response interpretation of PID control	
	Time delay systems Root locus and frequency response of time delay systems Smith predictor	
	Digital control	
	Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers	
	Software tools Introduction to Matlab, Simulink, Control toolbox	
	Computer-based exercises throughout the course	
Literature	 Werner, H., Lecture Notes "Introduction to Control Systems" G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009 K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010 R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010 	



Course L0655: Introduction to Control Systems	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M1279: MED II: Intro	oduction to Biochemistry and Molecul	ar Biology		
Courses				
Γitle		Тур	Hrs/wk	CP
ntroduction to Biochemistry and Molecular	Biology (L0386)	Lecture	2	3
Module Responsible	Prof. Hans-Jürgen Kreienkamp			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached	d the following learning results		
Professional Competence				
Knowledge	The students can			
	and a collection to the formation to an			
	describe basic biomolecules; explain how genetic information is coded in the second code.	the DNA:		
	 explain how genetic information is coded in the explain the connection between DNA and present the connection			
	- explain the connection between DNA and pr	otoms,		
Skills	The students can			
	recognize the importance of molecular parar	maters for the course of a disease.		
	describe selected molecular-diagnostic proc			
	explain the relevance of these procedures for			
	explain the relevance of these procedures to	a some diseases		
Personal Competence				
Social Competence	The students can participate in discussions in resea	rch and medicine on a technical level.		
Autonomy	The students can develop understanding of topics fr	rom the course using technical literature by themse	lugo	
Autonomy	The students can develop understanding of topics in	on the course, using technical literature, by themse	ives.	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 2	28		
Credit points	3			
Examination	Written exam			
Examination duration and scale	60 minutes			
Assignment for the Following	General Engineering Science (German program): S	pecialisation Mechanical Engineering, Focus Biome	echanics: Compulsory	
Curricula	General Engineering Science (German program): S	pecialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 s	semester): Specialisation Biomedical Engineering: 0	Compulsory	
	General Engineering Science (German program, 7 s			npulsory
	Electrical Engineering: Specialisation Medical Tech	nology: Elective Compulsory		
	General Engineering Science (English program): Sp	pecialisation Mechanical Engineering, Focus Biome	chanics: Compulsory	
	General Engineering Science (English program): Sp			
	General Engineering Science (English program, 7 s	emester): Specialisation Mechanical Engineering, F	ocus Biomechanics: Con	pulsory
	General Engineering Science (English program, 7 s			
	Mechanical Engineering: Specialisation Biomechan	, ,	,	
	Biomedical Engineering: Specialisation Manageme		γ	
	Biomedical Engineering: Specialisation Artificial Organic	·	•	
	Biomedical Engineering: Specialisation Medical Tec		,	
	Biomedical Engineering: Specialisation Implants an			
	Technomathematics: Core qualification: Elective Co	' ' '		
	Technomathematics: Specialisation III. Engineering	·		

Course L0386: Introduction to Biochemistry and Molecular Biology	
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Hans-Jürgen Kreienkamp
Language	DE
Cycle	WiSe
Content	
Literature	Müller-Esterl, Biochemie, Spektrum Verlag, 2010; 2. Auflage
	Löffler, Basiswissen Biochemie, 7. Auflage, Springer, 2008



Module M1333: BIO I: Impla	ints and Fracture Healing
Courses	
Title	Typ Hrs/wk CP
Implants and Fracture Healing (L0376)	Lecture 2 3
Module Responsible	Prof. Michael Morlock
Admission Requirements	None
Recommended Previous	It is recommended to participate in "Introduction into Anatomie" before attending "Implants and Fracture Healing".
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The students can describe the different ways how bones heal, and the requirements for their existence.
	The students can name different treatments for the spine and hollow bones under given fracture morphologies.
Skilla	The children and determine the forces esting within the human hady under quasi static situations under an eife accumptions
Skills	The students can determine the forces acting within the human body under quasi-static situations under specific assumptions.
Personal Competence	
Social Competence	The students can, in groups, solve basic numerical modeling tasks for the calculation of internal forces.
A. (a. a. a	The state of the s
Autonomy	The students can, in groups, solve basic numerical modeling tasks for the calculation of internal forces.
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Credit points	3
Examination	Written exam
Examination duration and scale	90 min
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Curricula	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	Mechanical Engineering: Specialisation Biomechanics: Compulsory
	Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory
	Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory
	Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory
	Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory



Course L0376: Implants and Fractur	re Healing	
-	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Michael Morlock	
Language	DE WiSe	
	Topics to be covered include:	
	Introduction (history, definitions, background importance)	
	2. Bone (anatomy, properties, biology, adaptations in femur, tibia, humerus, radius)	
	3. Spine (anatomy, biomechanics, function, vertebral bodies, intervertebral disc, ligaments)	
	3.1 The spine in its entirety	
	3.2 Cervical spine	
	3.3 Thoracic spine	
	3.4 Lumbar spine	
	3.5 Injuries and diseases	
	4. Pelvis (anatomy, biomechanics, fracture treatment)	
	5 Fracture Healing	
	5.1 Basics and biology of fracture repair	
	5.2 Clinical principals and terminology of fracture treatment	
	5.3 Biomechanics of fracture treatment	
	5.3.1 Screws	
	5.3.2 Plates	
	5.3.3 Nails	
	5.3.4 External fixation devices	
	5.3.5 Spine implants	
	6.0 New Implants	
Literature	Cochran V.B.: Orthopādische Biomechanik	
	Mow V.C., Hayes W.C.: Basic Orthopaedic Biomechanics	
	White A.A., Panjabi M.M.: Clinical biomechanics of the spine	
	Nigg, B.: Biomechanics of the musculo-skeletal system	
	Schiebler T.H., Schmidt W.: Anatomie	
	Platzer: dtv-Atlas der Anatomie, Band 1 Bewegungsapparat	



Module M0829: Foundation	
Courses	
Title	Typ Hrs/wk CP
Introduction to Management (L0880)	Lecture 3 3
Project Entrepreneurship (L0882)	Problem-based Learning 2 3
Module Responsible	
Admission Requirements	
Recommended Previous Knowledge	
Educational Objectives	
Professional Competence	
Knowledge	
Skills	 explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions fror field of Management explain the most important aspects of and goals in Management and name the most important aspects of entreprneurial projects describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and huressource management, information management, innovation management and marketing explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives and uncertainty, and ex some basic methods from mathematical Finance state basics from accounting and costing and selected controlling methods. Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry ou Entrepreneurship project in a team. In particular, they are able to analyse Management goals and structure them appropriately analyse organisational and staff structures of companies apply methods for decision making under multiple objectives, under uncertainty and under risk analyse production and procurement systems and Business information systems analyse and apply basic methods of marketing select and apply basic methods from mathematical finance to predefined problems apply basic methods from accounting, costing and controlling to predefined problems
Personal Competence Social Competence	
Autonomy	 Students are able to work in a team and to organize the team themselves to write a report on their project.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	
Examination	
Examination duration and scale	
Assignment for the Following	
Curricula	
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Energy and Environmental Engineering: Compulsory
	General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compul
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
	Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

ompulsory

 $General\ Engineering\ Science\ (German\ program, 7\ semester): Specialisation\ Mechanical\ Engineering, Focus\ Energy\ Systems: Compulsory$

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

 $\label{thm:condition} \textbf{General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory and the state of the stat$

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program); Specialisation Energy and Environmental Engineering; Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program): Specialisation Process Engineering: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Electrical\ Engineering:\ Compulsory$

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Process\ Engineering:\ Compulsory$

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Compulsory\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Mechanical\ Engineering,\ M$

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 $\label{thm:mechanical} \textbf{Mechanical Engineering: Core qualification: Compulsory}$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Course L0880: Introduction to Mana	gement		
Тур	Lecture		
Hrs/wk	3		
CP	3		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42		
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga		
	ersten, Prof. Matthias Meyer, Prof. Thomas Wrona		
Language	DE		
Cycle	WiSe/SoSe		
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects 		
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008 Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003 Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006. Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001. Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008. Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005. Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008. Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.		

Course L0882: Project Entrepreneurship	
Тур	Problem-based Learning
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept, using their knowledge from the corresponding lecture. Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Module M0634: Introductio	n into Medical Technology and Systems			
Courses				
Title		Тур	Hrs/wk	CP
Introduction into Medical Technology and		Lecture	2	3
Introduction into Medical Technology and		Project Seminar	2	2
ntroduction into Medical Technology and		Recitation Section (large)	1	1
Module Responsible	Prof. Alexander Schlaefer			
Admission Requirements	none			
Recommended Previous	principles of math (algebra, analysis/calculus)			
Knowledge	principles of stochastics			
	principles of programming, R/Matlab			
Educational Objectives	After taking part successfully, students have reached th	e following learning results		
Professional Competence				
Knowledge	The students can explain principles of medical technol	ogy, including imaging systems, computer aided s	urgery, and medical ir	formation systems. The
	are able to give an overview of regulatory affairs and st	andards in medical technology.		
Skills	The students are able to evaluate systems and medical	devices in the context of clinical applications.		
Personal Competence				
Social Competence	The students describe a problem in medical technology	y as a project, and define tasks that are solved in a	joint effort.	
Autonomy	The students can reflect their knowledge and documen	t the results of their work. They can present the resu	ults in an appropriate r	nanner.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Spec	cialisation Biomedical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 sem	nester): Specialisation Biomedical Engineering: Co	mpulsory	
	Computer Science: Specialisation Computer and Softw	rare Engineering: Elective Compulsory		
	Electrical Engineering: Core qualification: Elective Corr	npulsory		
	General Engineering Science (English program): Speci	ialisation Biomedical Engineering: Compulsory		
	General Engineering Science (English program, 7 sem	ester): Specialisation Biomedical Engineering: Cor	npulsory	
	Computational Science and Engineering: Specialisatio	n Engineering Sciences: Elective Compulsory		
	Computational Science and Engineering: Specialisatio	n Computer Science: Elective Compulsory		
	Biomedical Engineering: Specialisation Artificial Organ	s and Regenerative Medicine: Elective Compulsory	/	
	Biomedical Engineering: Specialisation Implants and E	ndoprostheses: Elective Compulsory		
	Biomedical Engineering: Specialisation Medical Techn	ology and Control Theory: Elective Compulsory		
	Biomedical Engineering: Specialisation Management a	and Business Administration: Elective Compulsory		
	Technomathematics: Specialisation III. Engineering Sci	ence: Elective Compulsory		

Course L0342: Introduction into Med	dical Technology and Systems
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Alexander Schlaefer
Language	DE
Cycle	SoSe
Content	- imaging systems
	- computer aided surgery
	- medical sensor systems
	- medical information systems
	- regulatory affairs
	- standard in medical technology
	The students will work in groups to apply the methods introduced during the lecture using problem based learning.
Literature	Wird in der Veranstaltung bekannt gegeben.

Course L0343: Introduction into Med	dical Technology and Systems
Тур	Project Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Alexander Schlaefer
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L1876: Introduction into Med	dical Technology and Systems
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Alexander Schlaefer
Language	DE
Cycle	SoSe
Content	
Literature	



Module M1280: MED II: Intr	oduction to Physiology	
Courses		
Title	Typ Hrs/wk CP	
Introduction to Physiology (L0385)	Lecture 2 3	
Module Responsible	Dr. Roger Zimmermann	_
Admission Requirements	None	
Recommended Previous	None	
Knowledge		
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge	The students can	
	describe the basics of the energy metabolism;	
	 describe the dasks of the energy metaborism, describe physiological relations in selected fields of muscle, heart/circulation, neuro- and sensory physiology. 	
	,	
Skills	The students can describe the effects of basic bodily functions (sensory, transmission and processing of information, development of forces and	vi
	functions) and relate them to similar technical systems.	
Personal Competence		
Social Competence	The students can conduct discussions in research and medicine on a technical level.	
	The students can find solutions to problems in the field of physiology, both analytical and metrological.	
Autonomy	The students can derive answers to questions arising in the course and other physiological areas, using technical literature, by themselves.	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Credit points	3	
Examination	Written exam	
Examination duration and scale	60 minutes	
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
	Electrical Engineering: Specialisation Medical Technology: Elective Compulsory	
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
	Mechanical Engineering: Specialisation Biomechanics: Compulsory	
	Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory	
	Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory	
	Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory	
	Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory	
	Technomathematics: Core qualification: Elective Compulsory	
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory	

Course L0385: Introduction to Phys	iology
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Roger Zimmermann
Language	DE
Cycle	SoSe
Content	
Literature	Taschenatlas der Physiologie, Silbernagl Despopoulos, ISBN 978-3-135-67707-1, Thieme
	Repetitorium Physiologie, Speckmann, ISBN 978-3-437-42321-5, Elsevier



ourses				
itle		Тур	Hrs/wk	СР
xperimental Methods in Biomechanics (L	0377)	Lecture	2	3
Module Responsible	Prof. Michael Morlock			
Admission Requirements	None			
Recommended Previous	It is recommended to participate in "Implantate un	d Frakturheilung" before attending "Experimentelle	e Methoden".	
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ned the following learning results		
Professional Competence				
Knowledge	The students can describe the different ways how	bones heal, and the requirements for their existen	ce.	
	The students can name different treatments for the	e spine and hollow bones under given fracture mo	rphologies.	
	The students can describe different measuremen	t techniques for forces and movements, and choos	e the adequate technique for	r a given task.
Skills	The students can describe the basic handling of s	several experimental techniques used in biomecha	nics.	
Personal Competence				
Social Competence	The students can, in groups, solve basic experime	ental tasks.		
Autonomy	The students can, in groups, solve basic experime	ental tasks.		
Workload in Hours	Independent Study Time 62, Study Time in Lectur	re 28		
Credit points	3			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program)	: Specialisation Mechanical Engineering, Focus Bi	omechanics: Compulsory	
Curricula	General Engineering Science (German program)	: Specialisation Biomedical Engineering: Compuls	ory	
	General Engineering Science (German program,	7 semester): Specialisation Mechanical Engineering	ng, Focus Biomechanics: Co	mpulsory
	General Engineering Science (German program,	7 semester): Specialisation Biomedical Engineering	ng: Compulsory	
	General Engineering Science (English program):	Specialisation Biomedical Engineering: Compulso	ory	
	General Engineering Science (English program):	Specialisation Mechanical Engineering, Focus Bio	mechanics: Compulsory	
	General Engineering Science (English program,	7 semester): Specialisation Mechanical Engineering	ng, Focus Biomechanics: Cor	mpulsory
	General Engineering Science (English program,	7 semester): Specialisation Biomedical Engineerin	g: Compulsory	
	Mechanical Engineering: Specialisation Biomech			
		Organs and Regenerative Medicine: Elective Comp	oulsory	
	Biomedical Engineering: Specialisation Implants			
		Technology and Control Theory: Elective Compulso	•	
		ment and Business Administration: Elective Compu	lsory	
	Technomathematics: Specialisation III. Engineering	ng Science: Elective Compulsory		

Course L0377: Experimental Method	ds in Biomechanics
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Michael Morlock
Language	DE
Cycle	SoSe
Content	
Literature	Wird in der Veranstaltung bekannt gegeben



Specialization Naval Architecture

The Bachelor Course "Naval Architecture" prepares by the elective modules for scientific tasks in naval architecture, ocean engineering and related mechanical engineering disciplines. Thus, the occupational orientation can either related to the design of ships or offshore systems, or to more dedicated areas, such as hydrodynamics or strength of structures.

odule M0833: Introductio	on to Control Systems		
ourses			
tle	Тур	Hrs/wk	СР
roduction to Control Systems (L0654)	Lecture	2	4
roduction to Control Systems (L0655)	Recitation Section (small)	2	2
Module Responsible	Prof. Herbert Werner		
Admission Requirements	none		
Recommended Previous	Representation of signals and systems in time and frequency domain, Laplace transform		
Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge		and a few and late and a second	
	Students can represent dynamic system behavior in time and frequency domain, and can in p .	articular explain propertie	es of first and second
	systems		
	They can explain the dynamics of simple control loops and interpret dynamic properties in term	ms of frequency response	and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.		
	They can explain the role of the phase margin in analysis and synthesis of control loops		
	They can explain the way a PID controller affects a control loop in terms of its frequency response.		
	They can explain issues arising when controllers designed in continuous time domain are implementation.	olemented digitally	
Skills			
SKIIIS	Students can transform models of linear dynamic systems from time to frequency domain and	vice versa	
	They can simulate and assess the behavior of systems and control loops		
	They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules		
	They can analyze and synthesize simple control loops with the help of root locus and frequency.	cy response techniques	
	They can calculate discrete-time approximations of controllers designed in continuous-time at		nentation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out thes		
	, ,		
Personal Competence			
Social Competence	Students can work in small groups to jointly solve technical problems, and experimentally validate the	eir controller designs	
Autonomy	Students can obtain information from provided sources (lecture notes, software documentation, e	experiment quides) and i	use it when solving
		experiment guides) and i	use it writer solving
	problems.	experiment guides) and i	use it when solving
		experiment guides) and i	use it when solving
		experiment guides) and t	use it when solving
	problems.	saperiment guides) and i	use it when solving
	problems.	speriment guides) and t	ase it when solving
	problems.	speriment guides) and t	ase it with solving
Workload in Hours	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress.	speriment guides) and t	ase it with solving
Workload in Hours Credit points	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56	speriment guides) and t	ase it wien sowing
	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56	speriment guides) and t	ase it wien solving
Credit points	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam	speriment guides) and i	use it wien solving
Credit points Examination Examination duration and scale	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min	speriment guides) and i	ase it with solving
Credit points Examination	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory		use it wien solving
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Core	mpulsory	use it wien solving
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering	mpulsory g: Compulsory	use it wien solving
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor	mpulsory g: Compulsory mpulsory	ase it with solving
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com	mpulsory g: Compulsory mpulsory pulsory	ase it with solving
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering:	mpulsory g: Compulsory mpulsory pulsory Compulsory	ase it wien solving
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering:	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: General Engineering Science (German program, 7 semester): Specialisation Energy and Environment	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls	
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: General Engineering Science (German program, 7 semester): Specialisation Energy and Environment General Engineering Science (German program, 7 semester): Specialisation Energy and Environment General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General En	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls	ory
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: General Engineering Science (German program, 7 semester): Specialisation Energy and Environment	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls	ory
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: General Engineering Science (German program, 7 semester): Specialisation Energy and Environment General Engineering Science (German program, 7 semester): Specialisation Energy and Environment General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General En	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C	ory
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering General Engineering Science (German program, 7 semester): Specialisation Energy and Environment General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Mechanical Eng	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C	ory ompulsory Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering General Engineering Science (German program, 7 semester): Specialisation Energy and Enviroment General Engineering Science (German program, 7 semester): Specialisation Process Engineering: C General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems	ory ompulsory Compulsory Engineering: Compu
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering General Engineering Science (German program, 7 semester): Specialisation Energy and Enviroment General Engineering Science (German program, 7 semester): Specialisation Process Engineering: C General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems	ory ompulsory Compulsory Engineering: Compu
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: C General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems eering, Focus Materials	ory ompulsory Compulsory Engineering: Compu in Engineering Scie
Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Energy and Enviroment General Engineering Science (German program, 7 semester): Specialisation Process Engineering: C General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems eering, Focus Materials	ory ompulsory Compulsory Engineering: Compu in Engineering Scie
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Written exam Izo min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Core General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Core General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Comeral Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: General Engineering Science (German program, 7 semester): Specialisation Energy and Environment General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems eering, Focus Materials	ory ompulsory Compulsory Engineering: Compu in Engineering Scie Mechanical Engine
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Corgeneral Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Corgeneral Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Comgeneral Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Energy and Enviroment General Engineering Science (German program, 7 semester): Specialisation Process Engineering: General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems eering, Focus Materials	ory ompulsory Compulsory Engineering: Compu in Engineering Scie Mechanical Engine
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Corgeneral Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Congeneral Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Comgeneral Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: General Engineering Science (German program, 7 semester): Specialisation Process Engineering: General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems eering, Focus Materials tering, Focus Theoretical	ory ompulsory compulsory Engineering: Compu in Engineering Scie Mechanical Engineering
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Buritten exam Independent Study Time 124, Study Time in Lecture 56 General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Core General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Core General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Comeral Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: General Engineering Science (German program, 7 semester): Specialisation Process Engineering: General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems eering, Focus Materials tering, Focus Theoretical	ory ompulsory compulsory Engineering: Compu in Engineering Scie Mechanical Engineering
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Burith exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Comgeneral Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Comgeneral Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Comgeneral Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Energy and Environment General Engineering Science (German program, 7 semester): Specialisation Process Engineering: General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compuls	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems eering, Focus Materials tering, Focus Theoretical	ory ompulsory compulsory Engineering: Compu in Engineering Scie Mechanical Engineering
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Independent Specialisation Compulering Science (German program, 7 semester): Specialisation New Independent 50 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Le	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems eering, Focus Materials tering, Focus Theoretical	ory ompulsory compulsory Engineering: Compu in Engineering Scie Mechanical Engineering
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Civil Engineering General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering General Engineering Science (German program, 7 semester): Specialisation Energy and Environment General Engineering Science (German program, 7 semester): Specialisation Process Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester):	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems eering, Focus Materials tering, Focus Theoretical	ory ompulsory compulsory Engineering: Compu in Engineering Scie Mechanical Engineering
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Independent Specialisation Compulering Science (German program, 7 semester): Specialisation New Independent 50 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Lecture 56 Independent Study Time 124, Study Time in Le	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems eering, Focus Materials tering, Focus Theoretical	ory ompulsory compulsory Engineering: Compu in Engineering Scie Mechanical Engineering
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering General Engineering Science (German program, 7 semester): Specialisation Civil Engineering General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering General Engineering Science (German program, 7 semester): Specialisation Energy and Environment General Engineering Science (German program, 7 semester): Specialisation Process Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering General Engineering Science (German program, 7 semester):	mpulsory g: Compulsory mpulsory pulsory Compulsory g: Compulsory tal Engineering: Compuls compulsory g, Focus Mechatronics: C g, Focus Biomechanics: C g, Focus Aircraft Systems eering, Focus Materials tering, Focus Theoretical	ory ompulsory compulsory Engineering: Compu in Engineering Scie Mechanical Engineering



General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

 $General\ Engineering\ Science\ (English\ program,\ 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Aircraft\ Systems\ Engineering:\ Compulsory\ Specialisation\ Mechanical\ Engineering:\ Compulsory\ Mechanical\ Engineering:\ Mech$ General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory



Course LOSE 4. Introduction to Contr	val Custama
Course L0654: Introduction to Contr	
Тур	
Hrs/wk	
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	
Cycle	WiSe
Content	Signals and systems
	Linear systems, differential equations and transfer functions
	First and second order systems, poles and zeros, impulse and step response
	Stability
	Feedback systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Root locus techniques
	Root locus plots
	Root locus design of PID controllers
	Frequency response techniques
	Troquerdy reception techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation Francisco and interest the second control of t
	Frequency response interpretation of PID control
	Time delay systems
	Root locus and frequency response of time delay systems
	Smith predictor
	Digital control
	Sampled-data systems, difference equations
	Tustin approximation, digital implementation of PID controllers
	Software tools
	Introduction to Matlab, Simulink, Control toolbox
	Computer-based exercises throughout the course
Literature	 Werner, H., Lecture Notes "Introduction to Control Systems" G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009 K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010

Course L0655: Introduction to Contr	rol Systems
Тур	Recitation Section (small)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



courses	
itle	Typ Hrs/wk CP
computer Engineering (L0321) computer Engineering (L0324)	Lecture 3 4 Recitation Section (small) 1 2
Module Responsible	
Admission Requirements	
Recommended Previous	
Knowledge	
	The successful completion of the labs will be honored during the evaluation of the module's examination according to the following rules:
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the successful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	
•	gates. The module includes the following topics:
	a total district
	Introduction Combinational legis: Cates Replace placehae Replace functions bardways continued a combinational naturalist.
	 Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks Sequential logic: Flip-flops, automata, systematic hardware design
	Technological foundations
	Computer arithmetic: Integer addition, subtraction, multiplication and division
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining
	Memories: Memory hierarchies, SRAM, DRAM, caches
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses
Claille	The students are size a second or story the continues and the story of the continues of the story of the stor
SKIIIS	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the physical compositio computer systems. The students can analyze, how highly specific and individual computers can be built based on a collection of few and sir
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing systems - from gates and circ
	up to complete processors.
	After successful completion of the module, the students are able to judge the interdependencies between a physical computer system and the software and the software computer system and the system an
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-centric abstraction layers
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels have on an entire system.
	performance and to propose feasible options.
Personal Competence	
Social Competence	Students are able to solve similar problems alone or in a group and to present the results accordingly.
Social Competence	
Social Competence	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.
Social Competence Autonomy	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56
Social Competence Autonomy Workload in Hours	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56
Social Competence Autonomy Workload in Hours Credit points	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam
Social Competence Autonomy Workload in Hours Credit points Examination	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Metatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Metatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Metatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Beral Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engin
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engi
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 B Written exam 99 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Decension Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Engineering Science (German program, 7 semeste
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 B Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Diametric Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Meterials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Derman program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Derman program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Derman program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engin
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatroics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Develo
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, F
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alteralt Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alteralt Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisat
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Dispracess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alteralt Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (Engineering Science (Engineering Science (Engineering Science (Engineering Science (Engineering Science (Engineering Science (Engineeri
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alteralt Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alteralt Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisat

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

General Engineering Science and Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	ng
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	Introduction Combinational Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005.

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



odule M0829: Foundatior				
ourses				
le		Тур	Hrs/wk	CP
roduction to Management (L0880) Dject Entrepreneurship (L0882)		Lecture Problem-based Learning	3	3
Module Responsible	Prof. Christoph Ihl	1 Toblem-based Learning		3
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following lea	rning results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of man Marketing and Innovation, and also to Investment and Controlling. In		nagement, from Plani	ning and Organisation
Skills	explain the differences between Economics and Managemen field of Management explain the most important aspects of and goals in Managemen describe and explain basic business functions as production ressource management, information management, innovation explain the relevance of planning and decision making in Esome basic methods from mathematical Finance state basics from accounting and costing and selected control Students are able to analyse business units with respect to control Entrepreneurship project in a team. In particular, they are able to analyse Management goals and structure them appropriately analyse organisational and staff structures of companies apply methods for decision making under multiple objectives, analyse production and procurement systems and Business in analyse and apply basic methods of marketing	ant and name the most important aspin, procurement and sourcing, supply management and marketing usiness, esp. in situations under multing methods. Ifferent criteria (organization, objection)	ects of entreprneurial _l chain management, ultiple objectives and	orojects organization and hum uncertainty, and expla
Personal Competence Social Competence	work successfully in a team of students to apply their knowledge from the lecture to an entrepreneursl	to predefined problems	t on the project	
Autonomy	to communicate appropriately and to cooperate respectfully with their fellow students. Students are able to work in a team and to organize the team themselves to write a report on their project.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation Elec	trical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Programs General Engineering Science (German program): Specialisation Biog General Engineering Science (German program): Specialisation Ene General Engineering Science (German program): Specialisation Civi General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Med General Engineering Science (German program): Specialisation Nav General Engineering Science (German program, 7 semester): Specia	rocess Engineering: Compulsory rgy and Enviromental Engineering: Co and Enviromental Engeneering: Co- hanical Engineering: Compulsory nedical Engineering: Compulsory al Architecture: Compulsory lisation Electrical Engineering: Compulsation Process Engineering: Compulsation Biomedical Engineering: Collisation Naval Architecture: Compuls lisation Computer Science: Compuls lisation Bioprocess Engineering: Col	mpulsory pulsory ulsory mpulsory ory ory mpulsory ry	y
	General Engineering Science (German program, 7 semester): Special Compulsory General Engineering Science (German program, 7 semester): Special Engineering Science (G	lisation Mechanical Engineering, Foo lisation Mechanical Engineering, Foo ecialisation Mechanical Engineerin	cus Biomechanics: Co cus Aircraft Systems E g, Focus Materials in	mpulsory ngineering: Compulso Engineering Science



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

ompulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

 $General\ Engineering\ Science\ (English\ program):\ Specialisation\ Bioprocess\ Engineering:\ Compulsory$

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program); Specialisation Process Engineering; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 $\label{thm:mechanical engineering:Core qualification:Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



	Landon	
Тур	Lecture	
Hrs/wk		
CP		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	rof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgar	
Laumiana	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona DE	
Language	WiSe/SoSe	
Content	WIGE/SUGE	
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management 	
	Important definitions from Management,	
	Developing Objectives for Business, and their relation to important Business functions	
	Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management	
	Marketing and Sales	
	Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management	
	 Definitions as information, information systems, aspects of data security and strategic information systems 	
	 Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. 	
	Relevance of marketing, B2B vs. B2C-Marketing	
	 different techniques from the field of marketing (e.g. scenario technique), pricing strategies 	
	important organizational structures	
	basics of human ressource management	
	 Introduction to Business Planning and the steps of a planning process 	
	 Decision Analysis: Elements of decision problems and methods for solving decision problems 	
	Selected Planning Tasks, e.g. Investment and Financial Decisions	
	 Introduction to Accounting: Accounting, Balance-Sheets, Costing 	
	Relevance of Controlling and selected Controlling methods	
	Important aspects of Entrepreneurship projects	
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008	
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003	
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.	
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.	
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.	
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.	
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.	
	Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.	

Course L0882: Project Entrepreneu	rship
Тур	Problem-based Learning
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,
	using their knowledge from the corresponding lecture.
	Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Module M0854: Mathematic	es IV				
Courses					
Title			Тур	Hrs/wk	СР
Differential Equations 2 (Partial Differential	Equations) (L1043)		Lecture	2	1
Differential Equations 2 (Partial Differential			Recitation Section (small)	1	1
Differential Equations 2 (Partial Differential	Equations) (L1045)		Recitation Section (large)	1 2	1
Complex Functions (L1038) Complex Functions (L1041)			Lecture Recitation Section (small)	1	1
Complex Functions (L1042)			Recitation Section (large)	1	1
Module Responsible	Prof. Anusch Taraz				
Admission Requirements	none				
Recommended Previous	Mathematics 1 - III				
Knowledge					
Educational Objectives	After taking part successfully, students have reached the fo	ollowing learning	results		
Professional Competence					
Knowledge					
	Students can name the basic concepts in Mathema				
	Students can discuss logical connections between		They are capable of illustrating th	ese connections w	ith the help of examples.
	They know proof strategies and can reproduce then	m.			
Skills	Students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in Mathematics IV with the students can model problems in the students can be students. - The students can be students. - The students can be students can be students can be students can be students. - The students can be students can be students can be students. - The students can be students can be students can be students. - The students can be students can be students can be students. - The students can be students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The students can be students can be students. - The stu	rith the help of the	concepts studied in this course.	Moreover, they are	capable of solving then
	by applying established methods.				
	Students are able to discover and verify further logic	ical connections b	etween the concepts studied in the	ne course.	
	For a given problem, the students can develop and	execute a suitable	le approach, and are able to critic	ally evaluate the re	sults.
Personal Competence					
Social Competence					
,	Students are able to work together in teams. They a				
	In doing so, they can communicate new concepts		needs of their cooperating partne	ers. Moreover, they	can design examples to
	check and deepen the understanding of their peers	3.			
Autonomy	Students are capable of checking their understand	ding of complex o	oncents on their own. They can	snecify onen aues	tions precisely and know
	where to get help in solving them.	ang or complex o	oncepte on their own may can	oposity oposit quoe	acro producely and lines
	Students have developed sufficient persistence to be	be able to work fo	r longer periods in a goal-oriente	d manner on hard i	problems.
	·				
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112				
Credit points	6				
Examination	Written exam				
Examination duration and scale	60 min (Complex Functions) + 60 min (Differential Equation	ns 2)			
Assignment for the Following	General Engineering Science (German program): Specialis		Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialis			cs: Compulsory	
Curricula	General Engineering Science (German program): Specialis		•		eering: Compulsorv
	General Engineering Science (German program): Specialis		-	ooamoai Engili	g. compalacty
	General Engineering Science (German program, 7 semest		, ,	sory	
	General Engineering Science (German program, 7 semest			-	mpulsory
	General Engineering Science (German program, 7 semi	, ·	0 0,		, ,
	Compulsory	, ,	g · g , ·		3 · · · · ·
	General Engineering Science (German program, 7 semest	ter): Specialisation	n Naval Architecture: Compulsory	/	
	Computer Science: Specialisation Computational Mathema	atics: Elective Co	mpulsory		
	Electrical Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialis	sation Electrical E	ngineering: Compulsory		
	General Engineering Science (English program): Specialis	sation Naval Arch	itecture: Compulsory		
	General Engineering Science (English program): Specialis	sation Mechanica	I Engineering, Focus Mechatronic	cs: Compulsory	
	General Engineering Science (English program): Specialis	sation Mechanica	I Engineering, Focus Theoretical	Mechanical Engine	eering: Compulsory
	General Engineering Science (English program, 7 semeste	er): Specialisation	n Electrical Engineering: Compuls	sory	
	General Engineering Science (English program, 7 semeste	er): Specialisation	Mechanical Engineering, Focus	Mechatronics: Cor	npulsory
	General Engineering Science (English program, 7 seme	ester): Specialisa	ation Mechanical Engineering, F	ocus Theoretical I	Mechanical Engineering
	Compulsory				
	General Engineering Science (English program, 7 semeste	er): Specialisation	Naval Architecture: Compulsory		
	Computational Science and Engineering: Specialisation E	ingineering Scien	ces: Elective Compulsory		
1	Computational Science and Engineering: Specialisation C	Computer Science	: Elective Compulsory		
1	Mechanical Engineering: Specialisation Theoretical Mechanical	anical Engineerin	g: Compulsory		
1	Mechanical Engineering: Specialisation Mechatronics: Cor	mpulsory			
	Mechatronics: Core qualification: Compulsory				
	Naval Architecture: Core qualification: Compulsory				
I	Theoretical Mechanical Engineering: Technical Compleme	entary Course Co	re Studies: Elective Compulsory		



Course L1043: Differential Equation	s 2 (Partial Differential Equations)
Тур	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	Main features of the theory and numerical treatment of partial differential equations
	 Examples of partial differential equations First order quasilinear differential equations Normal forms of second order differential equations Harmonic functions and maximum principle Maximum principle for the heat equation Wave equation Liouville's formula Special functions Difference methods Finite elements
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html

Course L1044: Differential Equations 2 (Partial Differential Equations)		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1045: Differential Equations 2 (Partial Differential Equations)	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1038: Complex Functions	
Тур	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	Main features of complex analysis
	Functions of one complex variable Complex differentiation Conformal mappings Complex integration Cauchy's integral theorem Cauchy's integral formula Taylor and Laurent series expansion Singularities and residuals Integral transformations: Fourier and Laplace transformation
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html



Course L1041: Complex Functions	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1042: Complex Functions	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



woulde wood: wechanics	IV (Kinetics II, Oscillations, Analytical Mechar	nics, Mullibody Systems)		
Courses				
ïtle		Тур	Hrs/wk	СР
lechanics IV (Kinetics II, Oscillations, And	alytical Mechanics, Multibody Systems) (L1137)	Lecture	3	3
lechanics IV (Kinetics II, Oscillations, Ana	alytical Mechanics, Multibody Systems) (L1138)	Recitation Section (small)	2	2
Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) (L1139) Recitation Section (large) 1 1				1
Module Responsible	Prof. Robert Seifried			
Admission Requirements	none			
Recommended Previous	Mathematics I-III and Mechanics I-III			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ving learning results		
Professional Competence				
Knowledge	The students can			
	describe the axiomatic procedure used in mechanical avalage important stops in model design:	contexts,		
	explain important steps in model design;present technical knowledge.			
	present technical knowledge.			
Skills	The students can			
	avalain the important elements of mathematical / moch	anical analysis and model formation, and an	nly it to the contact of	thair own problems:
	 explain the important elements of mathematical / mech apply basic methods to engineering problems; 	anical analysis and model formation, and ap	ply it to the context of	their own problems,
	 estimate the reach and boundaries of the methods and 	l extend them to be applicable to wider proble	am cate	
	estimate the reach and boundaries of the methods and	rextend them to be applicable to wider proble	3111 3013.	
Personal Competence				
Social Competence				
Social Competence	The students can work in groups and support each other to overcome difficulties.			
Autonomy	Students are capable of determining their own strengths and $\boldsymbol{\theta}$	veaknesses and to organize their time and le	arning based on thos	se.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
	6			
Credit points				
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisati			
Curricula	General Engineering Science (German program): Specialisati			
	General Engineering Science (German program): Specialisati			
	General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semester)			
	General Engineering Science (German program, 7 semester)			
	General Engineering Science (English program): Specialisation		or y	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program, 7 semester):		npulsorv	
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester):			
	Mechanical Engineering: Core qualification: Compulsory	,	•	
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science:	Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			
	Theoretical Mechanical Engineering: Technical Complementa	ury Course Core Studios: Floative Compulsor	.,	

Course L1137: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Lecture	
Hrs/wk	3	
CP	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	- Simple impact problems	
	- Principles of analytical mechanics	
	- Elements of vibration theory	
	- Vibration of Multi-degree of freedom systems	
	- Multibody Systems	
Literature	K. Magnus, H.H. Müller-Slany: Grundlagen der Technischen Mechanik. 7. Auflage, Teubner (2009).	
	D. Gross, W. Hauger, J. Schröder, W. Wall: Technische Mechanik 1-4. 11. Auflage, Springer (2011).	
	W. Schiehlen, P. Eberhard: Technische Dynamik, Springer (2012).	



Course L1138: Mechanics IV (Kineti	ourse L1138: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Recitation Section (small)		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Robert Seifried		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Course L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Maria I Marcon El II Dans				
Module M0680: Fluid Dynai	mics			
Courses				
Title		Тур	Hrs/wk	СР
Fluid Mechanics (L0454)		Lecture	3	4
Fluid Mechanics (L0455)		Recitation Section (large)	2	2
Module Responsible	Prof. Thomas Rung			
Admission Requirements	none			
Recommended Previous	Sound knowledge of engineering mathematics, engineering m	echanics and thermodynamics.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	Students will have the required sound knowledge to explain the	ne general principles of fluid engineering an	d physics of fluids.	Students can scientificall
	outline the rationale of flow physics using mathematical mode	els and are familiar with methods for the per	formance analysis a	and the prediciton of fluid
	engineering devices.			
Skills	Students are able to apply fluid angine oring principles and flor	w physics models for the applysic of technic	al ayatama. The leat	re enables the student to
Skills	Students are able to apply fluid-engineering principles and flor carry out all necessary theoretical calculations for the fluid dyna			re enables the student to
	carry out an necessary medical calculations for the fluid dyna	ariic design of engineering devices on a scie	inano level.	
Personal Competence				
Social Competence	The students are able to discuss problems and jointly develop	solution strategies.		
Autonomy	The students are able to develop solution strategies for comple	x problems self-consistent and crtically anal	se results.	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	on Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):	·	ry	
	General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program): Specialisatio General Engineering Science (English program, 7 semester): \$	• •	nulsorv	
	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S		-	
	Computational Science and Engineering: Specialisation Engin		•	
	Mechanical Engineering: Core qualification: Compulsory	, , , , , , , , , , , , , , ,		
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: E	lastina Cassanilas III		

Course L0454: Fluid Mechanics	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Thomas Rung
Language	DE
Cycle	SoSe
Content	Overview Physical/mathematical modelling Special phenomena Basic equations of fluid dynamics The turbulence problem One dimensional theory for inkompressibel flows One dimensional theory for kompressibel flows Flow over contours without friction Flow over contours with friction Flow through channels Simplified equations for three dimensional flow Special aspects of the numerical solution for complex flows
Literature	 Herwig, H.: Strömungsmechanik, 2. Auflage, Springer- Verlag, Berlin, Heidelberg, 2006 Herwig, H.: Strömungsmechanik von A-Z, Vieweg Verlag, Wiesbaden, 2004



Course L0455: Fluid Mechanics		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Thomas Rung	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0640: Stochastics	s and Ship Dynamics				
Courses					
Title		Тур	Hrs/wk	CP	
Ship Dynamics (L0352)		Lecture	2	3	
Ship Dynamics (L1620)	And the company of Ocean Traditionalism (LOCAL)	Recitation Section (small)	1 2	1	
	aval Architecure and Ocean Engineering (L0364)	Lecture	2	3	
•	Prof. Moustafa Abdel-Maksoud				
Admission Requirements	None				
Recommended Previous	Technical mechanics				
Knowledge	Linear algebra, analysis, complex numbers				
	Fluid mechanics				
Educational Objectives	After taking part successfully, students have reached the following I	earning regulte			
Professional Competence	The wing part successions, students have reached the following in	ourning results			
Knowledge	- The students are able to give an overview over various manoeu	ivres. They can name application goal	s and they can desc	ribe the procedure of the	
	manoeuvres.	The second secon			
	- The students are able to give an overview over varius rudder type	- The students are able to give an overview over varius rudder types. They can name criteria in the rudder design.			
	- The students can name computation methods which are used to d	etermine forces and motions in waves.			
Skills				em.	
	- The students are able to determine hydrodynamic coefficients and they can explain their physical meaning.				
	The students can explain how a rudder works and they can explain the physical effects which can occur.				
	- The students can mathematically describe waves.				
	- The students can explain the mathematically description of harmo	ncial motions in waves and they can de	termine them.		
Personal Competence					
Social Competence	- The students can arrive at work results in groups and document th	em.			
	- The students can discuss in groups and explain their point of view				
Autonomy	- The students can assess their own strengthes and weaknesses at	nd the define further work steps on this b	pasis.		
Workload in Hours	Independent Study Time 140, Study Time in Lecture 70				
Credit points	7				
Examination	Written exam				
Examination duration and scale	180 min				
Assignment for the Following	General Engineering Science (German program): Specialisation No.	aval Architecture: Compulsory		- 	
Curricula	General Engineering Science (German program, 7 semester): Spec	cialisation Naval Architecture: Compulse	ory		
	General Engineering Science (English program): Specialisation Na	val Architecture: Compulsory			
	General Engineering Science (English program, 7 semester): Spec	ialisation Naval Architecture: Compulso	ry		
	Naval Architecture: Core qualification: Compulsory				



Course L0352: Ship Dynamics	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Moustafa Abdel-Maksoud
Language	DE
Cycle	SoSe
Content	Maneuverability of ships
	 Equations of motion Hydrodynamic forces and moments Linear equations and their solutions Full-scale trials for evaluating the maneuvering performance Regulations for maneuverability Rudder Seakeeping Representation of harmonic processes Motions of a rigid ship in regular waves Flow forces on ship cross sections Strip method Consequences induced by ship motion in regular waves Behavior of ships in a stationary sea state Long-term distribution of seaway influences
Literature	 Abdel-Maksoud, M., Schiffsdynamik, Vorlesungsskript, Institut für Fluiddynamik und Schiffstheorie, Technische Universität Hamburg-Harburg 2014 Abdel-Maksoud, M., Ship Dynamics, Lecture notes, Institute for Fluid Dynamic and Ship Theory, Hamburg University of Technology, 2014 Bertram, V., Practical Ship Design Hydrodynamics, Butterworth-Heinemann, Linacre House - Jordan Hill, Oxford, United Kingdom, 2000 Bhattacharyya, R., Dynamics of Marine Vehicles, John Wiley & Sons, Canada, 1978 Brix, J. (ed.), Manoeuvring Technical Manual, Seehafen-Verlag, Hamburg, 1993 Claus, G., Lehmann, E., Östergaard, C.). Offshore Structures, I+II, Springer-Verlag. Berlin Heidelberg, Deutschland, 1992 Faltinsen, O. M., Sea Loads on Ships and Offshore Structures, Cambridge University Press, United Kingdom, 1990 Handbuch der Werften, Deutschland, 1986 Jensen, J. J., Load and Global Response of Ships, Elsevier Science, Oxford, United Kingdom, 2001 Lewis, Edward V. (ed.), Principles of Naval Architecture - Motion in Waves and Controllability, Society of Naval Architects and Marine Engineers Jersey City, NJ, 1989 Lewandowski, E. M., The Dynamics of Marine Craft: Maneuvering and Seakeeping, World Scientific, USA, 2004 Lloyd, A., Ship Behaviour in Rough Weather, Gosport, Chichester, Sussex, United Kingdom, 1998

Course L1620: Ship Dynamics		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Moustafa Abdel-Maksoud	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0364: Statistics and Stocha	astic Processes in Naval Architecure and Ocean Engineering
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Volker Müller
Language	DE
Cycle	WiSe
Content	 descriptive statistics, parameter, criteria for outliers sample, sample space, probability, probability space Bayes method, conditional probability, law of total probability Discrete and continuous random variables Probability distributions mixed and joint random variables and their distribution Characteristics of random variables (expectation, variance, skewness, kurtosis,) (central) limit theorem Stochastic processes Statistical description of seaway, harmonic analysis of seaway narrow-banded Gaussian process, seaway and its characteristics sea- and wind spectra transformation of spectra, transfer function
Literature	V. Müller, Statistik und Stochastik in der Schiffs- und Meerestechnik, Vorlesungsskript, Institut für Fluiddynamik und Schiffstheorie, Technische Universität Hamburg-Harburg, 2014 W. Blendermann "Grundlagen der Wahrscheinlichkeitsrechnung", Vorlesungsskript, Arbeitsbereich Fluiddynamik und Schiffstheorie, Technische Universität Hamburg-Harburg, 2001 H. W. Coleman, W. G. Steele, Experimentation and Uncertainty Analysis for Engineers, 3 rd Edition, John Wiley & Sons, Inc., New York, NY, 2009 ITTC Recommended Procedures and Guidelines, In: Quality Systems Manual, International Towing Tank Conference (ITTC), 2011 F.M. Dekking, C. Kraaikamp, H.P. Lopuhaä, L.E. Meester, A Modern Introduction To Probability and Statistics, Springer, 2005 Springer Handbook of Engineering Statistics, H. Pham (Hrsg.), Springer, 2006 A. Klenke, Wahrscheinlichkeitstheorie, Springer, 2013



Module M0655: Computation	onal Fluid Dynamics I			
Courses				
Title		Тур	Hrs/wk	CP
Computational Fluid Dynamics I (L0235) Computational Fluid Dynamics I (L0419)		Lecture Recitation Section (large)	2	3
Module Responsible	Prof. Thomas Rung	riecitation dection (large)	2	3
Admission Requirements	None			
Recommended Previous	None			
Knowledge	 Mathematical Methods for Engineers 			
ouge	 Fundamentals of Differential/integral calculus and series exp 	ansions		
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence	The land grant outdood and for the land and	arring rooms		
Knowledge	The students are able to list the basic numerics of partial differential	equations.		
		- 4		
Skills	The students are able develop appropriate numerical integration	in space and time for the governing	partial differential ed	quations. They can code
	computational algorithms in a structured way.			
Personal Competence				
Social Competence	The students can arrive at work results in groups and document then	n.		
Autonomy	The students can independently applying approaches to callying app	oifia probleme		
Autonomy	The students can independently analyse approaches to solving spe	cilic problems.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	2h			
Assignment for the Following	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Energy S	Systems: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Na	• •		
	General Engineering Science (German program, 7 semester): Spec			
	General Engineering Science (German program, 7 semester): Spec	-	cus Energy Systems: I	Elective Compulsory
	General Engineering Science (English program): Specialisation Nav			
	General Engineering Science (English program): Specialisation Me			
	General Engineering Science (English program, 7 semester): Speci General Engineering Science (English program, 7 semester): Speci	·	•	lective Compulsory
	Naval Architecture: Core qualification: Compulsory	ansausti westiainsal Eligilleeliig, Foc	us Elielyy Systellis: E	iecave Compulsory
	Technomathematics: Specialisation III. Engineering Science: Electiv	e Compulsory		
	Technomathematics: Specialisation III. Engineering Science: Electiv			
	. 5 5			

Course L0235: Computational Fluid Dynamics I			
Тур	ecture		
Hrs/wk			
CP	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Thomas Rung		
Language	DE		
Cycle	WiSe		
Content	undamentals of computational modelling of thermofluid dynamic problems. Development of numerical algorithms.		
	Partial differential equations Foundations of finite numerical approximations		
	 3. Computation of potential flows 4. Introduction of finite-differences 5. Approximation of convective, diffusive and transient transport processes 		
	6. Formulation of boundary conditions and initial conditions 7. Assembly and solution of algebraic equation systems 8. Facets of weighted -residual approaches 9. Finite volume methods 10. Basics of grid generation		
Literature	Ferziger and Peric: Computational Methods for Fluid Dynamics, Springer		



Course L0419: Computational Fluid Dynamics I			
Тур	citation Section (large)		
Hrs/wk	2		
CP	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Thomas Rung		
Language	DE		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		



Module M0659: Fundamen	tals of Ship Structural Design and Analysis			
Courses				
Title		Tue	Hrs/wk	CP
Fundamentals of Ship Structural Design (I	0.411)	Typ Lecture	2 2	2
Fundamentals of Ship Structural Design (I		Recitation Section (small)	1	2
Fundamentals of Ship Structural Analysis		Lecture	2	2
Fundamentals of Ship Structural Analysis		Recitation Section (small)	1	2
Module Responsible	Prof. Sören Ehlers		· ·	
Admission Requirements	None			
Recommended Previous	Mechanics I - III			
Knowledge	Fundamentals of Materials Science I - III			
Kilomeage	Welding Technology I			
	Fundamentals of Mechanical Design I - III			
	Tundamentais of Mechanical Design 1 - III			
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	Students can reproduce the basic contents of the structural be	haviour of ship structures; they can explain	the theory and meth	ods for the calculation of
	deformations and stresses in beam-like structures.			
	Furthermore, they can reproduce the basis contents of codes	(rules) materials comi finished products	ioining and principle	oc of ctructural docian o
		(rules), materials, semi-imistred products,	joining and principle	es or structural design t
	components in the ship structure.			
Skills	Students are capable of applying the methods and tools for th	e calculation of linear deformations and stre	esses in the above m	entioned structures; the
	can choose calculation models of typical ship structures.			
	Furthermore, they are capable to apply the methods of drawing and sizing the ship structure; they can select suitable materials, semi-finished products			
	and joints.			
Personal Competence				
Social Competence	The students are able to communicate and cooperate in a profe	essional environment in the shipbuilding and	d component supply i	ndustry.
4.4	The state of the s	at a state of the section of the section of	for a selection of his con-	19
Autonomy	The students are capable to independently idealize real ship	structures and to select suitable methods	for analysis of beam	i-like structures; they are
	capable to assess the results of structural analyses.			
	Furthermore, they are capable to assess drawings of comple	ex ship structures and to design ship struc	tures for various requ	uirements and boundar
	conditions.			
Workload in Hours	Independent Study Time 156 Study Time in Lecture 94			
	Independent Study Time 156, Study Time in Lecture 84			
Credit points Examination				
	Written exam			
Examination duration and scale	3 hours	a Naval Arabita shura Casanulan		
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program, 7 semester):		ory	
	General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program, 7 semester): S	Specialisation Naval Architecture: Compulso	ry	
	Naval Architecture: Core qualification: Compulsory			



Course L0411: Fundamentals of Ship Structural Design				
Тур	Lecture			
Hrs/wk	2			
СР	2			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28			
Lecturer	Prof. Sören Ehlers			
Language	DE			
Cycle	WiSe			
Content	Chapters:			
	1. Introduction			
	3. Class societies and their tasks			
	4. Materials for steel shipbuilding			
	Welding and Cutting			
	Semi-finished products in steel shipbuilding			
	Determining the scantlings for local loads			
	Longitudinal strength of the hull girder			
	Determining the scantlings of longitudinal structural members			
	10. Determining the scantlings of bottom and side structures			
	11. Decks and Hatch Openings			
	12. Effective breadth			
	13. Iterative determination of scantlings (POSEIDON)			
Literature	Vorlesungsskript mit weiteren Literaturangaben wird über das Internet verfügbar gemacht			

Course L0413: Fundamentals of Ship Structural Design				
Тур	Recitation Section (small)			
Hrs/wk	1			
СР	2			
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14			
Lecturer	Prof. Sören Ehlers			
Language	DE			
Cycle	WiSe			
Content	Chapters:			
	1. Introduction			
3. Class societies and their tasks				
	4. Materials for steel shipbuilding			
	5. Welding and Cutting			
	6. Semi-finished products in steel shipbuilding			
	7. Determining the scantlings for local loads			
	8. Longitudinal strength of the hull girder			
	Determining the scantlings of longitudinal structural members			
	10. Determining the scantlings of bottom and side structures			
	11. Decks and Hatch Openings			
	12. Effective breadth			
	13. Iterative determination of scantlings (POSEIDON)			
Literature	Vorlesungsskript mit weiteren Literaturangaben wird über das Internet verfügbar gemacht			

Course L0410: Fundamentals of Ship Structural Analysis				
Тур	sture			
Hrs/wk	2			
CP	2			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28			
Lecturer	Prof. Sören Ehlers			
Language				
Cycle	WiSe			
Content	Contents:			
	1. Introduction			
	2. Finite element method (f.e. method) by the example of trussworks			
	3. Force methods for frameworks			
	4. F.e. method for frameworks			
	5. Shear and torsion in thin-walled beams			
	6. Beams subjected to longitudinal forces			
Literature	Vorlesungsskript mit weiteren Literaturangaben; div. Bücher über die Methode der finiten Elemente			



Course L0414: Fundamentals of Ship Structural Analysis				
Тур	tation Section (small)			
Hrs/wk	1			
CP	2			
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14			
Lecturer	Prof. Sören Ehlers			
Language	DE			
Cycle	WiSe			
Content	Content Contents:			
	1. Introduction			
	2. Finite element method (f.e. method) by the example of trussworks			
	3. Force methods for frameworks			
	4. F.e. method for frameworks			
	5. Shear and torsion in thin-walled beams			
	6. Beams subjected to longitudinal forces			
Literature	Vorlesungsskript mit weiteren Literaturangaben; div. Bücher über die Methode der finiten Elemente			



Module M0664: Structural D	Design and Construction of Ships				
modalo modo ii otractarar i					
Courses					
Title		Тур	Н	rs/wk	CP
Ship Structural Design (L0412)		Lecture	2		3
Ship Structural Design (L0415)		Recitation Section	n (small) 2		3
Welding Technology (L1123)		Lecture	3		3
Module Responsible	Prof. Sören Ehlers				
Admission Requirements	None				
Recommended Previous	Mechanics I - III				
Knowledge	Fundamentals of Materials Science I - III				
	Welding Technology I				
	Fundamentals of Mechanical Design I - III				
Educational Objectives	After taking part successfully, students have reache	d the following learning results			
Professional Competence					
Knowledge	Students can reproduce design and sizing as well	as fabrication of the different areas of sl	hip structures and of diffe	erent ship types	(incl. detail design);
	they can describe calculation models for complex s	tructures.			
Skills Personal Competence	Students are capable to specify the requirements for different ship types and areas of the hull, to define design criteria for the components, to select suitable calculation models and to assess the chosen structure				
	Students are concluded a present their structural deci	ian and discuss their decisions construct	ivolvin o group		
Social Competence	Students are capable to present their structural des	ign and discuss their decisions constituct	ivery in a group.		
Autonomy	Students are capable to design independently diff methods.	erent structural areas of the ship hull a	nd different ship types a	and to define ap	propriate fabrication
Workload in Hours	Independent Study Time 172, Study Time in Lecture	98			
Credit points	9				
Examination	Written exam				
Examination duration and scale	3 hours				
Assignment for the Following	General Engineering Science (German program): S	Specialisation Naval Architecture: Compu	lsory		
Curricula	General Engineering Science (German program, 7	semester): Specialisation Naval Architec	ture: Compulsory		
	General Engineering Science (English program): S				
	General Engineering Science (English program, 7 s				
	Naval Architecture: Core qualification: Compulsory				
	womeotare. Sore quanneation. compulsory				

Course L0412: Ship Structural Design			
Тур	ecture		
Hrs/wk			
СР	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Sören Ehlers		
Language	DE		
Cycle	SoSe		
Content	Chapters:		
	1. Bulkheads and tanks 2. Structural design of forebodies 3. Structures in engine rooms 4. Aft bodies and rudders 5. Detail structural design 6. Outfitting 7. Bulk carriers 8. Tankers 9. Container ships 10. Production-kind steel structural design 11. Buckling and ultimate strength 12. Safety factors and reliability of structures		
Literature	Vorlesungsskript mit weiteren Literaturangaben wird über das Internet verfügbar gemacht		



Course L0415: Ship Structural Design		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Sören Ehlers	
Language	DE	
Cycle	SoSe	
Content	Chapters:	
Literature	1. Bulkheads and tanks 2. Structural design of forebodies 3. Structures in engine rooms 4. Aft bodies and rudders 5. Detail structural design 6. Outfitting 7. Bulk carriers 8. Tankers 9. Container ships 10. Production-kind steel structural design 11. Buckling and ultimate strength 12. Safety factors and reliability of structures	
Literature	Vorlesungsskript mit weiteren Literaturangaben wird über das Internet verfügbar gemacht	

Course L1123: Welding Technology				
Тур	Lecture			
Hrs/wk	3			
СР	3			
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Lecturer	of. Claus Emmelmann, Prof. Karl-Ulrich Kainer			
Language	DE			
Cycle	WiSe			
Content	- phase transitions, phase diagrams and thermal activated processes			
	- fundamentals of steels, heat treatment applications for steels and time temperature transformation diagrams			
	- properties of weldable carbon and fine grained steels			
	- properties of weldable low- and high-alloy steels, corrosion resistant steels and high-strength steels			
	- structure and properties of non-ferrite metals (aluminum, titanium)			
	NDT/DT Methods for materials and welds			
	gas fusion welding, fundamentals of electric arc welding technologies			
	structure and influence parameters for the welded joint			
	submerged arc welding/tungsten inert gas welding/inert gas metal arc welding (MIG)/active gas metal arc welding (MAG)/Plasma Welding			
	resistance welding/ polymer welding/ hybrid-welding			
	deposition welding			
	electron beam welding/ laser beam welding			
	- weld joint designs and declarations			
	- computation methods for weld joint dimensioning			
Literature	Schulze, G.: Die Metallurgie des Schweißens, 4. Aufl., Berlin 2010 Strassburg, F.W. und Wehner H.: Schweißen nichtrostender Stähle, 4. Aufl.			
	Düsseldorf, 2009 Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 1: Schweiß- und Schneidtechnologien, 3. Aufl., Berlin 2006.			
	Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 2: Verhalten der Werkstoffe beim Schweißen, 3. Aufl., Berlin 2005.			
	Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 3: Gestaltung und Festigkeit von Schweißkonstruktionen, 2. Aufl., Berlin 2002.			



Module M1109: Resistance	and Propulsion			
Courses				
Title		Тур	Hrs/wk	СР
Resistance and Propulsion (L1265)		Lecture	2	3
Resistance and Propulsion (L1266)		Recitation Section (large)	2	3
Module Responsible	Prof. Stefan Krüger			
Admission Requirements	None			
Recommended Previous	Madagelas			
Knowledge	Mechanics Third Property (a New J.A. white the state of the stat			
	Fluid Dynamics for Naval Architects			
	Hydrostratics			
Educational Objectives	After taking part successfully, students have reached the fo	ollowing learning results		
Professional Competence				
Knowledge	The hydrodynamic basics that are relevant for resistance	and propulsion of ships are discussed. The dif	erent resistance pheno	mena and their practica
	applications to hullform design as well as numerical and	empirical prediction methods are subject of the	course. Furthermore,	environmental additiona
	resistances are dealt with. The course includes model test techniques and their application to full scale ships. This hold also for propulsion and			
	hullefliciency elements, mainly thrust deduction and wake. Main Focus is how hull forms can be optimized for minimum and sustainable fue			
	consumption. The following topics are dealt with:			
	- Stillwater/added resistance, Wave resistance, Minimization of wave resistance, numerical prediction methods, friction laws, laminar/turbulent flow			
	separation, Hull form design for redcude flow separation, Appendage Design and resistance, Froude's resistance law,form factor method, thrust			
	deduction, wake, model scaling laws, resistance tests, free running propeller tests and propeller basics, propulsion tests, full scale speed power			
	predictions, additional resistances (wind, steering, current,	, sea state), EEDI, speed trials, contractual mat	ers concerning speed/p	oower, bunker claims
Skills	The student shall learn to design competitive hull forms with respect to fuel consumption by applying numreical techniques and to evaluate these hulls			
	by several progosis methods. Furtermore, the course will enable the student to clearl determine and minimize the required power including			
	environmental influences.			
Personal Competence				
Social Competence	The student learns to prepare technical matters in such a v	way that he can compte with his building suver	rision team.	
Autonomy	The student learns to prepare technical matters in such a v	way that he can compte with his building suver	rision team.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Speciali	sation Naval Architecture: Compulsory	<u> </u>	
Curricula	General Engineering Science (German program, 7 semes	ter): Specialisation Naval Architecture: Compul	sory	
	General Engineering Science (English program): Specialis	sation Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 semest	er): Specialisation Naval Architecture: Compuls	sory	
	Naval Architecture: Core qualification: Compulsory			

Course L1265: Resistance and Propulsion	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Stefan Krüger
Language	DE
Cycle	WiSe
Content	
Literature	

Course L1266: Resistance and Propulsion		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Stefan Krüger	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1118: Hydrostatic	s and Body Plan			
Courses				
Title		Тур	Hrs/wk	СР
Hydrostatics (L1260)		Lecture	2	3
Hydrostatics (L1261)		Recitation Section (large)	2	1
Body Plan (L1452)		Project Seminar	2	2
Module Responsible	Prof. Stefan Krüger			
Admission Requirements	None			
Recommended Previous	Good knowledge in Mathemathics I-III and Mechanics I-II			
Knowledge	It is recommended that the students are familiar with typical design relevant drawings, e.g. Body Plan, GA- Plan, Tank Plan etc.			
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge				
_	all following lectures in the subjects shipo design and saf	ety of ships.		
Skills	The student is able to carry out hydrostatic calculations to ensure that the ship has sufficient stability. He is able to design hull forms that are safe against			
	capsizing or sinking.			
Personal Competence				
Social Competence	The student gets access to hydrostatical problems.			
,	, ,			
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specia	lisation Naval Architecture: Compulsory		
Curricula	General Engineering Science (German program, 7 seme	ster): Specialisation Naval Architecture: Compuls	ory	
	General Engineering Science (English program): Special	isation Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 semes	ster): Specialisation Naval Architecture: Compulso	ory	
	Naval Architecture: Core qualification: Compulsory			

Course L1260: Hydrostatics		
	Lecture	
Hrs/wk		
CP	3	
Workload in Hours Lecturer	Independent Study Time 62, Study Time in Lecture 28 Prof. Stefan Krüger	
Language	DE	
Cycle		
Content	1. Numerical Integration, Diffrentation, Interpolation	
	- Trapezoidal Rule, Simpson, Tschebyscheff, graphical Integration Methods	
	- Determination of Areas, 1st and 2nd order Moments	
	- Numerical Diffrentation, Spline Interpolation	
	2. Buyoancy	
	- Principle of Archimedes	
	- Equlibrium Floating Condition	
	- Equlibrium Computations	
	- Hydrostatic Tables and Sounding Tables	
	- Trim Tables	
	3. Stability at large heeling angles	
	- Stability Equation	
	- Cross Curves of Stability and Righting Levers	
	- Numerical and Graphical Determination of Cross Curves	
	- Heeling Moments of Free Surfaces, Water on Deck, Water Ingress	
	- Heeling Moments of Different Type	
	- Balance of Heeling and Righting Moments acc. to BV 1030	
	- Intact Stability Code (General Critaria)	
	4. Linearization of Stability Problems	
	- Linearization of Restoring Forces and Moments	



- Correlation between Metacentric Height and Righting Lever at small heeling angles
- Computation of Path of Metacentric Height for Modern Hull Forms
- Correlation between Righting Lever and Path of Metacentric Height
- Hydrostatic Stiffness Matrix
- Definition of MCT
- Computation of Equilibrum Floating Conditions from Hydrostatic Tables
- Effect of Free Surfaces on Initial GM
- Roll Motions at Small Roll Angles
- 6. Stability in Waves
- Roll Motions at Large Amplitudes
- Pure Loss of Stability on the Wave Crest
- Principle of Parametric Excitation
- Principle of Direct Wave Moments
- Grim's Equivalent Wave Concept
- 6 Longitudinal Strength
- Longitudinal Mass Distribution, Shear Forces, Bending Moments
- Longitudinal Strength in Stability Booklet
- 7. Deadweight Survey and Inclining Experiment
- Deplacement Computations from Draft mark Readings
- Weights to go on /come from board
- Inclining Experiment with Heeling Moments from Weights and Heeling Tanks
- Residual Sounding Volumes
- Determination of COG from Metacentric height and from Cross Curves
- Roll Decay Test
- 8. Launching and Docking
 - Launching Plan, Arrangement of Launching Blocks
 - Rigid Body Launching: Tilting, Dumping, Equation of Techel
- Computation of Launching Event
- Bottom Pressure and Longitudinal Strength
- Linear- Elastic Effects
- Transversal Stability on Slipway and in Dock
- 9. Grounding
- Loss of Buoynacy when Grounded
- Pointwise Grounding
- Ship Grounds on Keel
- 10. Introduction into Damage Stability Problems
- Added Mass Method
- Loss of Buoyant Volume Method
- Simple Equilibrium Computations
- Intermediate Stages of Flooding (Addes Mass Method), Cross- and Downflooding
- Water Ingress Through Openings
- 11. Special Problems (optional and agreed upon)
- e.g. Heavy Lift Operations
- e.g. Jacking of Jackup Vessels
- e.g. Sinking After Water Ingress

Literature 1. Herner/Rusch: Die Theorie des Schiffes Fachbuchverlag Leipzig



2. Henschke
Schiffstechnisches Handbuch, Band 1
VEB Technik Verlag Berlin

3. Das Skript zur Vorlesung, Anwendungsbeispiele und Klausuren sind auf unserer Homepage abrufbar.

Course L1261: Hydrostatics	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Stefan Krüger
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1452: Body Plan	
Тур	Project Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Krüger
Language	DE
Cycle	WiSe
Content	As preparation for the lecture "Hydrostatics", the students must develop a body plan of a modern twin screw vessel (cruise liner, RoPAx- feryy, RoRo) and perform elementary volumetric computations. The body plan is to be developed from a given GA or can be designed freely. All computations shall be based on graphical integration methods. The body plan consists of: - Grid - approx. 20 sections, 5 Waterlines, 5 Buttocks - Computation Volume and centre of buoyancy for several drafts - Computation of Righting Lever curve for a given displacement based on and graphical integration for several heeling angles.
Literature	1. Herner/Rusch: Die Theorie des Schiffes Fachbuchverlag Leipzig 2. Henschke Schiffstechnisches Handbuch, Band 1 VEB Technik Verlag Berlin 3. Das Skript zur Vorlesung, Anwendungsbeispiele und Klausuren sind auf unserer Homepage abrufbar.



Courses				
Title		Тур	Hrs/wk	СР
Fundamentals of Materials Science I (L10	85)	Lecture	2	2
	vanced Ceramic Materials, Polymers and Composites) (L0506)	Lecture	2	2
Physical and Chemical Basics of Material		Lecture	2	2
Module Responsible	Prof. Jörg Weißmüller			
Admission Requirements	None			
Recommended Previous	Highschool-level physics, chemistry und mathematics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence		· · ·		
Knowledge	The students have acquired a fundamental knowledge on r	metals, ceramics and polymers a	and can describe this know	vledae comprehensiv
	Fundamental knowledge here means specifically the issues of			
	mechanical properties. The students know about the key aspe			
	characterizing specific properties. They are able to trace materia	Is phenomena back to the underlyi	ng physical and chemical lav	ws of nature.
Skills	The students are able to trace materials phenomena back to the			
	mechanical properties such as strength, ductility, and stiffness, or			
	solidification, precipitation, or melting. The students can explain		conditions and the materials	microstructure, and t
	can account for the impact of microstructure on the material's bel	havior.		
Personal Competence				
Social Competence	-			
Autonomy	-			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Energy and Enviromental Enginee	ering: Compulsory	
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): Sp		ing: Compulsory	
	General Engineering Science (German program, 7 semester): Sp	pecialisation Biomedical Engineeri	ng: Compulsory	
	General Engineering Science (German program, 7 semester): Sp	pecialisation Naval Architecture: Co	ompulsory	
	General Engineering Science (German program, 7 semester): Sp	pecialisation Energy and Envirome	ntal Engineering: Compulsor	ry
	Energy and Environmental Engineering: Core qualification: Com	pulsory		
	General Engineering Science (English program): Specialisation	Energy and Environmental Enginee	ring: Compulsory	
	General Engineering Science (English program): Specialisation	Mechanical Engineering: Compuls	sory	
	General Engineering Science (English program): Specialisation	Biomedical Engineering: Compuls	ory	
	General Engineering Science (English program): Specialisation	Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 semester): Sp	pecialisation Mechanical Engineeri	ng: Compulsory	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Biomedical Engineerin	ng: Compulsory	
	General Engineering Science (English program, 7 semester): Sp	pecialisation Naval Architecture: Co	ompulsory	
	General Engineering Science (English program, 7 semester): Sp	pecialisation Energy and Enviromen	ntal Engineering: Compulsor	у
	L	tive Compulsory		
	Logistics and Mobility: Specialisation Engineering Science: Elec	ave compaisory		
	Logistics and Mobility: Specialisation Engineering Science: Elec Mechanical Engineering: Core qualification: Compulsory	ave comparisory		
		ave compared y		
	Mechanical Engineering: Core qualification: Compulsory	ave compared y		

Course L1085: Fundamentals of Ma	Course L1085: Fundamentals of Materials Science I		
Тур	Lecture		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Jörg Weißmüller		
Language	DE		
Cycle	WiSe		
Content			
Literature	Vorlesungsskript		
	W.D. Callister: Materials Science and Engineering - An Introduction. 5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7		



Course L0506: Fundamentals of Ma	terials Science II (Advanced Ceramic Materials, Polymers and Composites)
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Bodo Fiedler, Prof. Gerold Schneider
Language	DE
Cycle	SoSe
Content	Chemische Bindungen und Aufbau von Festkörpern; Kristallaufbau; Werkstoffprüfung; Schweißbarkeit; Herstellung von Keramiken; Aufbau und
	Eigenschaften der Keramik; Herstellung, Aufbau und Eigenschaften von Gläsern; Polymerwerkstoffe, Makromolekularer Aufbau; Struktur und
	Eigenschaften der Polymere; Polymerverarbeitung; Verbundwerkstoffe
Literature	Vorlesungsskript
	W.D. Callister: Materials Science and Engineering -An Introduction-5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7

Course L1095: Physical and Chemic	cal Basics of Materials Science
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Müller
Language	DE
Cycle	WiSe
Content	Motivation: "Atoms in Mechanical Engineering?" Basics: Force and Energy The electromagnetic Interaction "Detour": Mathematics (complex e-funktion etc.) The atom: Bohr's model of the atom Chemical bounds The multi part problem: Solutions and strategies Descriptions of using statistical thermodynamics Elastic theory of atoms Consequences of atomar properties on makroskopic Properties: Discussion of examples (metals, semiconductors, hybrid systems)
Literature	Für den Elektromagnetismus: Bergmann-Schäfer: "Lehrbuch der Experimentalphysik", Band 2: "Elektromagnetismus", de Gruyter Für die Atomphysik: Haken, Wolf: "Atom- und Quantenphysik", Springer Für die Materialphysik und Elastizität: Hornbogen, Warlimont: "Metallkunde", Springer



Title Ti					
Title Design (1.200)	Module M1110: Ship Design	n			
Title Design (1.200)	Courses				
Sep Design (1,1826) Roctation Section (large) 2 3 3 3 3 3 3 3 3 3		▼		Here fords	0.0
Module Responsible Prof. Site Inc. Kridger None Prof. Site Inc. Kridger None Prof. Site Inc. Kridger None Prof. Site Inc. Kridger					
Moduse Responsible Admission Requirements Recommended Previous Knowledge Foliational Objectives Reducational Objectives Frofessional Competence Knowledge Frofessional Competence Knowledge The lecture stars with an overview about the importance and requirements of the aerly design phase. Competitive Elements of Ship Design throughly discussed. Typical budding contracts and the related bedincial risk are introduced. The most important main parameters of a ship introduced and their influence on the competitiveness of a design. The lecture focusses on the influence are little consecutive process elements. In this fector, the design changes are leaf with by simple models or form. The student shall turther learn to model complex systems properly so that the relavent technical conclusions can be drawn. The fecture continues with an introduction into the different phases of design project, from the initial design phase to a building contract. Further, me are introduced by generate budding specification relevant information at different levens of granularity during the different design stages. In deal following topics are adressed: - Structure of a building specification - Design of anial section and hull form - Design of anial section and hull form - Design of anial propulsion plant - Design of anial propulsion between the levent plant of the plant of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison thilling hybrical contact requirements within the Marine Environment. The lecture design has do not support the lecture Ship Design's the relevant methods to determine and judge upon the performance of a ship design are to values. Based on the lecture 'Principles of Ship Design's the relevant methods to determine and judge upon the performance of a ship design are to the little of procedures of			Continu (large)		
Admission Requirements Recommended Previous Knowledge Educational Objectives After taking part successfully, audents have reached the following learning results Professional Competence Knowledge The fecture starts with an overview about the importance and requirements of the early design phase. Competitive Elements of Ship Design introduced and their influence on the competitiveness of a design. The fecture focuses on the influence of alternated main parameters of a shill introduced and their influence on the competitiveness of a design. The fecture focuses on the influence of alternated main parameters of a shill introduced and their influence on the competitiveness of a design. The fecture focuses on the influence of alternated main parameters of a shill introduced and their influence on the competitiveness of a design. The fecture focuses on the influence of alternated main parameters of a shill introduced and their influence on the competitiveness of the feature focuses on the influence of alternated main parameters of a shill introduced and their influence on the competitiveness of design project, from the influence of alternated main parameters of a shill introduced and their influence of alternated main parameters of a shill introduced and their influence of alternated main parameters on the parameters of a shill introduced and their influence of alternated main parameters of a few parameters of a shill introduced and their influence of alternated main parameters of a shill introduced and their influence of alternated main parameters of a shill interpretate on the different parameters of a shill design phase to a building contract. Further, me are introduced to perentate interpretation of the section of a building specification. - Determination of Light Shilp Weight and Deadweight Components - Design of main propulsion plant - Design			section (large)	2	3
Professional Competence Knowledge Frofessional Competence Knowledge The lecture starts with an overview about the importance and requirements of the aerly design phase. Competitive Elements of Ship Design throughly discussed. Typical building contracts and the related technical risk are introduced. The most important man parameters of a ship design and the conceptiveness of a design. The lecture focusions of a ship design and the conceptiveness of a design. The lecture focusions of a technical risk are introduced. The most important man parameters of a ship design and the conceptiveness of a design. The lecture focusions of the indicated of the most important man parameters of a ship design and the consecutive process elements. In this lecture, the design changes are dealt with by simple models or from the sudent shall turther learn to model competiveness of a design. The lecture continues with an introduction into the different phases of design project, from the linitial design phase to a building specification relevant information at different levens of granularity during the different design stages. In detail following topics are adressed: - Structure of a building specification relevant information at different levens of granularity during the different design stages. In detail following topics are adressed: - Structure of a building specification of Light Ship Weight and Deadweight Components - Design of main propulsion plant - Design					
Flied Dynamics for Naval Architects, Resistance and Propulsion Resistance and Propulsion Resistance and Propulsion, Hydrostatics ### Professional Competence Knowledge Knowledge ### The lecture starts with an overview about the importance and requirements of the serify design phase. Competitive Elements of Ship Design throduced and their influence on the competitiveness of a design. The lecture focuses on the influence of alternated main parameters of a shi introduced and their influence on the competitiveness of a design. The lecture focuses on the influence of alternated main parameters of a ship introduced and their influence on the competitiveness of a design. The lecture focuses on the influence of alternated main parameters of a ship introduced and their influence on the competitiveness of a design. The lecture focuses on the influence of alternated main parameters of a ship introduced and their influence on the competitiveness of a design. The lecture focuses on the influence of alternated main parameters of a ship introduced and their influence on the competitiveness of the same influence of alternated main parameters of a ship introduced and their influence of alternated main parameters of a ship introduced and their influence of alternated main parameters of a ship introduced and their influence of alternated main parameters of a ship introduced and their influence of alternated main parameters of a ship design principle of a sent parameters of a ship design phase to a building contract. Further, me are introduced to generate building specification into the different phases of design parameters of a ship design phase to a building specification. - Determination of limiting of a building specification relevant information at different tevens of granularity during the different design stages. In deal to alternate the ship and the ship and the ship and the ship and parameters of a ship design and the ship and t		Notice			
Educational Objectives Professional Competence Knowledge The lecture starts with an overview about the importance and requirements of the aerly design phase. Competitive Elements of Ship Design throughly discussed. Typical building contracts and the related technical risk are introduced. The most important main parameters of a ship included and their influence on the competitiveness of a design. The feature focuses on the incode alternated main parameters of a ship design and the consecutive process elements. In this feature, the design changes are dealt with by simple models or form the student shall further learn to model competitiveness of a design. The feature focuses on the index of alternated main parameters of the performance of a ship design and the consecutive process elements. In this feature, the design changes are dealt with by simple models or form the subdent shall further learn to model competitiveness of a ship reproduced. The metal further learn to model competitiveness of the relevant technical conclusions can be drawn. The feature continues with an introduction into the different phases of design project, from the initial design phase to a building specification relevant information at different levens of granularity during the different design stages. In detail following pipes are addressed: Structure of a building specification Design of main proposition plant Design of structure and requisitions The student is made familiar with the basic design principles of seagoing meanthant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling hybrical contract requirements within the Marine Environment. The feature death the basic design predicts of a ship design with reportance of a s		Fluid Dynamics for Naval Architects, Resistance and Propulsion			
Professional Competence Knowledge The lecture starts with an overview about the importance and requirements of the aerly design phase. Competitive Elements of Ship Design thoroughly discussed. Typical building contracts and the related technical risk are introduced. The most important main parameters of a ship introduced and their influence on the competitiveness of a design. The lecture Scauses on the influence of alternated main parameters on the performance of a ship design and the consecutive process elements. In this lecture, the design begare are delt with by simple models or form. The lecture continues with an introduction into the different phases of design project, from the initial design phase to a building contract. Further, me are introduced to generate building specification relevant information at different levens of granularity during the different design stages. In detail tollowing topics are adressed: Structure of a building specification Design of main or Light Ship Weight and Deadweight Components Design of main propulsion plant Design of main grounds and transplant structural members Longitudinal strength Outfitting Components Relevant rules and regulations Skills The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The fecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfilment procedures of the covariance of the cov	Knowledge				
The lecture starts with an overview about the importance and requirements of the aerly design phase. Competitive Elements of Ship Design thoroughly discussed. Typical building contracts and the related technical risk are introduced. The most important main parameters of a being introduced and the most important main parameters of a being introduced and the hir influence of alternated main parameters on the performance of a ship design and the consecutive process elements. In this feature, the design changes are dealt with by simple models or form The student shall further learn to model complex systems properly so that the relavent technical conclusions can be drawn. The lecture continues with an introduction into the different phases of design project, from the initial design phase to a building contract. Further, me are introduced to generate building specification in the different phases of design project, from the initial design phase to a building specification in the different phases of design project, from the initial design phase to a building parameter of the building specification in the different phases of design project, from the initial design phase to a building specification or plant into main and different levens of granularity during the different design stages. In deal following by the different design stages in deal following parameters on the parameter of the parameter of the design stages in deal following are introduced in the design stages are deal with by simple models of the design stages. In deal following the different design stages. In deal following the design of main propulsion plant in the design and following the design and following the design and followi	Educational Objectives	After taking part successfully, students have reached the following learning results			
thoroughly discussed. Typical building contracts and the related technical risk are introduced. The most important main parameters of a ship introduced and their influence on the competitiveness of a design. The lecture flocusses on the influence of alternated main parameters on the performance of a ship design and the consecutive process elements. In this lecture, the design changes are dealt with by simple models or form. The student shall further learn to model complex systems properly so that the relavent technical conclusions can be drawn. The lecture continues with an introduction into the different phases of design project, from the initial design phase to a building contract. Further, me are introduced to generate building specification relevant information at different levens of granularity during the different design stages. In detail following typics are adressed: Structure of a building specification Determination of Light Ship Weight and Deadweight Components Design of amin section and hull form Design of main section and hull form Design of main propulsion plant Design of main propulsion plant Design of main section and flimiting Ghrequ- Curves Scantlings of most improtant structural members Longitudinal stength Outifiting Components Relevant rules and regulations Skills The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deal the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to lufilliment procedures of the carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deal the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to lufilliment procedures of	Professional Competence				
introduced and their influence on the competitiveness of a design. The lecture focuses on the influence of alternated main parameters on the performance of a ship design and the consecutive process elements. In this lecture, the design changes are dealt with by simple models or form The students half further learn to model complex systems properly so that the relevant calconalisations and be drawn. The lecture continues with an introduction into the different phases of design project, from the initial design phase to a building contract. Further, me are introduced to generate building specication relevant information at different levens of granularity during the different design stages. In detail following topics are adressed: - Structure of a building specification - Determination of Light Ship Weight and Deadweight Components - Design of atministed plants and manoevering devices - Design of atministed plants and manoevering devices - Design of atministed plants - Design of atministed plants - Design of ineit propulsion plant - Design of ineit propulsion - Determination of limiting GMrequ- Curves - Scanflings of most improbant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations - Skills - Relevant rules and regulations - Skills - The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the fecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The fecture death the basic design methods to determine the fundamantal technical characteristics of a beging with respect to fulfilliment procedures of the co-values. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge upon the performance of a sh	Knowledge	The lecture starts with an overview about the importance and requirements of the	aerly design phase. Com	petitive Elements	of Ship Designs are
performance of a ship design and the consecutive process elements. In this lecture, the design changes are dealt with by simple models or form. The student shall further learn to model complex systems properly so that the relavent technical conclusions can be drawn. The lecture continues with an introduction into the different phases of design project, from the initial design phase to a building contract. Further, me are introduced to generate building specification relevant information at different levens of granularity during the different design stages. In detail following topics are adressed: - Structure of a building specification - Determination of Light Ship Weight and Deadweight Components - Design of main section and hull form - Design of main propulsion plant - Design of subdivision - Determination of limiting GMrequi- Curves - Scanflings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant tules and regulations Skills The student is made familiar with the basic design principles of seagoing meanchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture dealt the basic design methods to determine the fundamental technical characteristics of a ship design with respect to fulfilliment procedures of the co-values. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge upon the performance of a ship design are treed. Personal Competence Social Competence Social Competence Social Competence Authoromy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Examination duration and scale Assignment for the Following General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineer		thoroughly discussed. Typical bulding contracts and the related technical risk are	introduced. The most imp	ortant main parar	meters of a ship are
The student shall further learn to model complex systems properly so that the relavent technical conclusions can be drawn. The lecture continues with an introduction into the different phases of design project, from the initial design phase to a building contract. Further, me are introduced to generate building specification relevant information at different levens of granularity during the different design stages. In detail following topics are adressed: - Structure of a building specification - Determination of Light Ship Weight and Deadweight Components - Design of tablooy lines and manoevering devices - Design of main section and hull form - Design of draibody lines and manoevering devices - Design of stabody lines and manoevering devices - Design of stabody lines and manoevering devices - Design of subdivision - Determination of limiting GMrequ- Curves - Scantlings of most improtant structural members - Longitudinal strength - Quiltiling Components - Relevant rules and regulations Skills The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at early out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Manne Environment. The lecture deals the basic design methods to determine the undamantal technical characteristics hip design with respect to fulfilliment procedures of the co-values. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge upon the performance of a ship design are tree. Personal Competence Scial Competence Scial Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his		introduced and their influence on the competitiveness of a design. The lecture focus	sses on the influence of al	ternated main par	rameters on the total
The lecture confinues with an introduction into the different phases of design project, from the initial design phase to a building contract. Further, me are introduced to generate building specification relevant information at different levens of granularity during the different design stages. In detail following topics are adressed: - Structure of a building specification - Determination of Light Ship Weight and Deadweight Components - Design of main section and hull form - Design of main section and hull form - Design of micro section and hull form - Design of subdivision - Determination of limiting GMrequ- Curves - Scantlings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations - Skills The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the co-values. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge upon the performance of a ship design are treed the students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - Workload in Hours - Workload in Hours - Workload in Hours - Autonomy - Standard Competence - Autonomy - Standard Competence - Autonomy - Standard Competence - Credit points - Standard Competence - Autonomy - Standard Competence - Standard Competence - Autonomy - Standard Competence - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - Morkload in Hours - The students learns to prepare technical matters in such a way the he can persuade his potantial customer again		performance of a ship design and the consecutive process elements. In this lecture,	the design changes are de	alt with by simple	models or formulae.
are introduced to generate building specification relevant information at different levens of granularity during the different design stages. In detail following topics are adressed: - Structure of a building specification - Determination of Light Ship Weight and Deadweight Components - Design of main section and hull form - Design of attbody lines and manoevering devices - Design of attbody lines and manoevering devices - Design of subdivision - Determination of limiting GMrequi- Curves - Scantlings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations - Skills - The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfilliment procedures of the covalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge upon the performance of a ship design are tree. - Personal Competence - Social Competence - Social Competence - Social Competence - Social Competence - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - The students learns to prepare technical ma		The student shall further learn to model complex systems properly so that the relavent t	echnical conclusions can b	e drawn.	
are introduced to generate building specification relevant information at different levens of granularity during the different design stages. In detail following topics are adressed: - Structure of a building specification - Determination of Light Ship Weight and Deadweight Components - Design of main section and hull form - Design of attbody lines and manoevering devices - Design of attbody lines and manoevering devices - Design of subdivision - Determination of limiting GMrequi- Curves - Scantlings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations - Skills - The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfilliment procedures of the covalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge upon the performance of a ship design are tree. - Personal Competence - Social Competence - Social Competence - Social Competence - Social Competence - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - The students learns to prepare technical ma		The lecture continues with an introduction into the different phases of design project from	om the initial design phase	to a building contr	ract Further methods
Structure of a building specification - Determination of Light Ship Weight and Deadweight Components - Design of main section and hull form - Design of affibody lines and manoevering devices - Design of main propulsion plant - Design of subdivision - Determination of limiting GMrequ- Curves - Scantlings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations Skills The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the co values. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge upon the performance of a ship design are tree. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination duration and scale is Assignment for the Following Curricula Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program); Specialisation Naval Architecture: Compulsory					
- Structure of a building specification - Determination of Light Ship Weight and Deadweight Components - Design of main section and hull form - Design of main section and hull form - Design of main propulsion plant - Design of subdivision - Determination of limiting GMrequ- Curves - Scanflings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations Skills The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the covalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are treed to the students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Fresholation duration and scale Examination Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory Guerral Engineering Science (German program): Specialisation Naval Architecture: Compulsory			no or grantiality during an	o amoroni accign	olagoo. II. dolali, ii.o
- Determination of Light Ship Weight and Deadweight Components - Design of main section and hull form - Design of atthody lines and manoevering devices - Design of subdivision - Determination of limiting GMrequ- Curves - Scantlings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations Skills - Relevant rules and regulations - The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deal the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the co-values. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence - Social Competence - Autonomy - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours - Gredit points - Gredit points - Kamination duration and scale - Examination duration and scale - Rasignment for the Following - General Engineering Science (German program): Specialisation Naval Architecture: Compulsory - General Engineering Science (German program): Specialisation Naval Architecture: Compulsory		is it is a second of the secon			
Components - Design of main section and hull form - Design of aftbody lines and manoevering devices - Design of main propulsion plant - Design of subdivision - Determination of limiting GMrequ- Curves - Scantlings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations - Skills - Skills - The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deal the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the co-values. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. - Personal Competence - Social Competence - Social Competence - Autonomy - The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. - Workload in Hours - Morkload in Hours - Morkload in Hours - Morkload in Hours - Reamination - Witten exam - Examination - Witten exam - Assignment for the Following - General Engineering Science (German program): Specialisation Naval Architecture: Compulsory - General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		- Structure of a building specification			
- Design of main section and hull form - Design of subdy lines and manoevering devices - Design of main propulsion plant - Design of subdivision - Determination of limiting GMrequ- Curves - Scantlings of most improtant structural members - Longitudinal strength - Outlifting Components - Relevant rules and regulations Skills The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the co-values. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are treed. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination duration and scale Examination duration and scale Examination duration and scale Assignment for the Following General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program): Specialisation Naval Architecture: Compulsory		- Determination of Light Ship Weight and Deadweight			
- Design of affibody lines and manoevering devices - Design of main propulsion plant - Design of subdivision - Determination of limiting GMrequ- Curves - Scantlings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations Skills The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture dealt the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the covalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination duration and scale Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program): Specialisation Naval Architecture: Compulsory		Components			
- Design of main propulsion plant - Design of subdivision - Determination of limiting GMrequ- Curves - Scantlings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the co values. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence Social Competence Autonomy Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Basignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory					
- Design of subdivision - Determination of limiting GMrequ- Curves - Scantlings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations Skills The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the convalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following General Engineering Science (German program). Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory					
- Determination of limiting GMrequ- Curves - Scantlings of most improtant structural members - Longitudinal strength - Outfiting Components - Relevant rules and regulations The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the covalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points 6 Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory					
- Scantlings of most improtant structural members - Longitudinal strength - Outfitting Components - Relevant rules and regulations Skills The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the covalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		- Design of subdivision			
- Longitudinal strength - Outfitting Components - Relevant rules and regulations The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the covalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		- Determination of limiting GMrequ- Curves			
- Outfitting Components - Relevant rules and regulations The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the covalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		- Scantlings of most improtant structural members			
- Relevant rules and regulations The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the convalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		- Longitudinal strength			
Skills The student is made familiar with the basic design principles of seagoing mearchant ships. The goal of the lecture is that the student shall be at carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the covalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are treed. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		- Outfitting Components			
carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the convalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		- Relevant rules and regulations			
carry out a concept design based on a vessel of comparison fulfilling typical contract requirements within the Marine Environment. The lecture deals the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the convalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	Skills	The student is made familiar with the basic design principles of seagoing mearchant	ships. The goal of the lect	ture is that the stu	ident shall be able to
the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the covalues. Based on the lecture "Principles of Ship Design" the relevant methods to determine and judge uopn the performance of a ship design are tree. Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory					
Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory					
Personal Competence Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory					
Social Competence Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		. , ,			. •
Autonomy The students learns to prepare technical matters in such a way the he can persuade his potantial customer against his competitors. Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points 6 Examination Written exam Examination duration and scale Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory					
Workload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points 6 Examination Written exam Examination duration and scale Assignment for the Following Curricula Curricula General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	·			•	
Credit points 6 Examination Written exam Examination duration and scale 180 min Assignment for the Following Curricula Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	Autonomy	The students learns to prepare technical matters in such a way the he can persuade his	s potantial customer agains	at his competitors.	
Examination Written exam Examination duration and scale Assignment for the Following Curricula C	Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Examination duration and scale Assignment for the Following Curricula Curric	Credit points	6			
Assignment for the Following Curricula General Engineering Science (German program): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	Examination	Written exam			
Curricula General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	Examination duration and scale	180 min			
	Assignment for the Following	General Engineering Science (German program): Specialisation Naval Architecture: Co	ompulsory		
Occasion Francisco (According Octaves (Francisco) Occasion (Francisco) Occasion (Francisco)	Curricula	General Engineering Science (German program, 7 semester): Specialisation Naval Arc	chitecture: Compulsory		
General Engineering Science (English program): Specialisation Naval Architecture: Compulsory		General Engineering Science (English program): Specialisation Naval Architecture: Co	ompulsory		
General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory		General Engineering Science (English program, 7 semester): Specialisation Naval Arc	hitecture: Compulsory		
Naval Architecture: Core qualification: Compulsory		Naval Architecture: Core qualification: Compulsory			

Course L1262: Ship Design	Course L1262: Ship Design	
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Stefan Krüger	
Language	DE	
Cycle	SoSe	
Content		
Literature		



Course L1264: Ship Design	Course L1264: Ship Design	
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Stefan Krüger	
Language	DE	
Cycle	SoSe	
Content		
Literature		



Specialization Process Engineering

Process engineering is the engineering discipline that conducts research into, develops, and realizes material change processes. It deals as a cross-sectional science with the conversion of materials in their nature, their properties, or their composition by means of physical, chemical, and biological processes with a view to producing usable intermediate or end products such as fuels, sugar, synthetics, proteins, cosmetics, dyestuffs, alcohols, plant protection products, or medications.

To achieve these targets, the process engineering study program aims to enable students to recognize and formulate laws by means of which apparatus, machinery, and entire manufacturing plants can be planned, calculated, designed, built, and operated. The product qualities required are to be achieved by means of safe and environmentally compatible processes and a rational use of energy and raw materials.

courses				
itle		Тур	Hrs/wk	CP
troduction into Process Engineering/Biop		Lecture	2	1
undamentals of material engineering (L08	·	Lecture	2	2
Module Responsible	Prof. Michael Schlüter			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached	I the following learning results		
Professional Competence				
Knowledge	After passing this module the students have the abil	ity to:		
	give an overview of the most important fields	on process and bioprocess engineering,		
	explain some working methods for different f			
Skille	After passing this module the students should have	the ability to:		
SKIIIS	After passing this module the students should have	the ability to.		
	 list and outline the most important fields of pr 	ocess engineering,		
	 name the most important working approache 	s or methods of the different fields of process engi	neering,	
	 read and prepare an engineering drawing, 			
	explain the most important technologies for v			
	 scheme typical chemical and biotechnologic 	al processes independently with the aid of pointer	S.	
Personal Competence				
Social Competence	The students are able to			
	work out results in groups and document the			
	provide appropriate feedback and handle fee	edback on their own performance constructively.		
Autonomy	The students are able to estimate their progress	of learning by themselves and to deliberate their	ir lack of knowledge in F	rocess Engineering
	Bioprocess Engineering.			
Workload in Hours	Independent Study Time 34, Study Time in Lecture 5	56		-
Credit points	3			
Examination				
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): S	pecialisation Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): S		v	
- Toulu	General Engineering Science (German program, 7 s			
	General Engineering Science (German program, 7 s	, ,		
	Bioprocess Engineering: Core qualification: Compu			
	General Engineering Science (English program): Sp	•	1	
	General Engineering Science (English program): Sp			
	General Engineering Science (English program, 7 s		mpulsory	
	General Engineering Science (English program, 7 s			
	Process Engineering: Core qualification: Compulsor			



Course L0829: Introduction into Process Engineering/Bioprocess Engineering		
Тур	Lecture	
Hrs/wk	2	
СР	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Dozenten des SD V	
Language	DE	
Cycle	WiSe	
Content	Introduction into the different research fields of the subject Process Engineering and Bioprocess Engineering.	
Literature	s. StudIP	

Course L0830: Fundamentals of ma	terial engineering	
Тур	Lecture	
Hrs/wk	2	
СР		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Marko Hoffmann	
Language	DE	
Cycle	WiSe	
Content	 Introduction Atomic structure and bonding Structure of solids Miller indices Imperfections in solids Texture Diffusion Mechanical properties Dislocations and strengthening mechanisms Phase transformations Phase diagrams, iron-carbon phase diagram Metallic materials Corrosion Polymeric materials Ceramic materials 	
Literature	 Bargel, HJ.; Schulze, G. (Hrsg.): Werkstoffkunde. Berlin u.a., Springer Vieweg, 2012. Bergmann, W.: Werkstofftechnik 1. München u.a., Hanser, 2009. Bergmann, W.: Werkstofftechnik 2. München u.a., Hanser, 2008. Callister, W. D.; Rethwisch, D. G.: Materialwissenschaften und Werkstofftechnik: eine Einführung, Übersetzungshrsg.: Scheffler, M., 1. Auflage Weinheim, Wiley-VCH, 2013. Seidel, W. W., Hahn, F.: Werkstofftechnik. München u.a., Hanser, 2012. 	



Module M0937: Physical Ch	hemistry			
-				
Courses				
Title		Тур	Hrs/wk	CP
Physical Chemistry (L0833) Physical Chemistry (L0835)		Lecture Laboratory Course	2	2
Module Responsible	Prof. Hans-Ulrich Moritz	Laboratory Course		<u> </u>
Admission Requirements	None			
Recommended Previous	Contents of the previous modules inorganic chemistry, physics for engine	ers and mathematics I-III.		
Knowledge	g,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
Educational Objectives	After taking part successfully, students have reached the following learnin	g results		
Professional Competence		-		
Knowledge	The students are able,			
	-to repeat the basic concepts of physical chemistry			
	-to describe and summarize the underlying concepts of mass-, heat- and	momentum transfer.		
	- to interpret phase diagrams and affiliate kinetic rate laws.			
Skills	The students are able to			
	- conduct (fundamental) thermodynamical, electrochemical and kinetic cal	Iculations.		
	- assess new applications with respect to environmental sustainability.			
	- abstract their knowldege to related issues to conduct thermodynamical,	electrochemical and kinetic calc	ulations.	
Personal Competence				
Social Competence	The students are able to plan, prepare, conduct and document experimen	its according to scientific guideli	nes in small groups.	
	The students are able to reflect their subject-specific knowledge orally in a	a team and to discuss it with fello	ow students and faculty.	
Autonomy	Students are able to assess their knowldege continuously on their own b	v exemplified practice. Students	are able to apply their	knowldege discretely to
,	plan, prepare and conduct experiments.	, ,	,,,	,
Workload in Hours	Independent Study Time 34, Study Time in Lecture 56			
Credit points	3			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Process	Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Bioproce	ess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisat		•	
	General Engineering Science (German program, 7 semester): Specialisat	ion Bioprocess Engineering: Ele	ective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program): Specialisation Process			
	General Engineering Science (English program): Specialisation Bioproce			
	General Engineering Science (English program, 7 semester): Specialisati		•	
	General Engineering Science (English program, 7 semester): Specialisati Process Engineering: Core qualification: Compulsory	on Bioprocess Engineering: Ele	cuve Compulsory	
	Frocess Engineering. Core quantication: Compulsory			

Course L0833: Physical Chemistry	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Hans-Ulrich Moritz, Dr. Werner Pauer
Language	DE
Cycle	WiSe
Content	State variables and state equations, ideal and real gases, first law, driving force of chemical reactions, chemical equilibria, introduction into kinetics of
	chemical reactions, introduction into transport phenomena, phase equilibria, equilibria at surfaces and interfaces
Literature	P. W. Atkins, J. de Paula: Physikalische Chemie, 5. Auflage, Wiley-VCH, 2013
	P. W. Atkins, J. de Paula: Kurzlehrbuch Physikalische Chemie, 4. Auflage, Wiley-VCH, 2008
	G. Wedler, HJ. Freund: Lehrbuch der Physikalischen Chemie, 6. Auflage, Wiley-VCH, 2012
	R. Reich: Thermodynamik - Grundlagen u. Anwendungen in der allgemeinen Chemie, 2. Auflage, Wiley-VCH, 1993
	U. Nickel: Lehrbuch der Thermodynamik - Eine verständliche Einführung, 2. Auflage, PhysChem-Verlag, 2011



Course L0835: Physical Chemistry	
Тур	Laboratory Course
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Hans-Ulrich Moritz, Dr. Werner Pauer
Language	DE
Cycle	WiSe
Content	Six laboratory experiments are conducted in groups of two students. The subjects of experimental investigations are:
	Reaction kinetics
	Freezing-point depression (cryoscopy)
	Electrical mobility of ions
	Viscosimetry
	Heat of neutralization
	Surface tension
	Before the practical conduct of the experiments a colloquium takes place in which the students explain, reflect and discuss the theoretical basics and their translation into practice.
	The students write up a report for every experiment. They receive feedback to their level of scientific writing (citation methods, labeling of graphs, etc.), so that they can improve their competence in this field over the course of the practical course.
Literature	Skript zum Chemiepraktikum III für Verfahrenstechniker, jeweils aktuelle Version, ca. 100 Seiten, PDF-Datei zum Download unter
	http://www.chemie.uni-hamburg.de/studium/nebenfach/tuhh3/studium/nebenfach/tuhh3/studium/nebenfach/tuhh3/Praktikum_2013_2014.html



	Engineering		
Courses			
ïtle	Typ Hrs/wk	CP	
Computer Engineering (L0321)	Lecture 3	4	
computer Engineering (L0324)	Recitation Section (small) 1	2	
Module Responsible			
Admission Requirements Recommended Previous			
Knowledge			
	The successful completion of the labs will be honored during the evaluation of the module's examination according to the fo	ollowing rules:	
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the successful labs, such that the examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.		
Educational Objectives			
Professional Competence			
Knowledge	This module deals with the foundations of the functionality of computing systems. It covers the layers from the assembly gates. The module includes the following topics:	y-level programming o	down
	Introduction		
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks		
	Sequential logic: Flip-flops, automata, systematic hardware design		
	Technological foundations		
	Computer arithmetic: Integer addition, subtraction, multiplication and division Region of computer architecture: Programming models, MIDS gingle available architecture, pipelining.		
	 Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining Memories: Memory hierarchies, SRAM, DRAM, caches 		
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses		
	,		
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and		
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a		
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing syst up to complete processors.	stems - from gates and	CITCL
	up to complete processors.		
	After successful completion of the module, the students are able to judge the interdependencies between a physical comp	puter system and the s	oftwa
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-consequences.	centric abstraction laye	ers fro
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction level	els have on an entire s	yster
	performance and to propose feasible options.		
Personal Competence			
Social Competence			
Autonomy	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.		
	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56		
	Independent Study Time 124, Study Time in Lecture 56		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Workload in Hours Credit points	Independent Study Time 124, Study Time in Lecture 56 6 Written exam		
Workload in Hours Credit points Examination	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs		
Workload in Hours Credit points Examination Examination duration and scale	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory		
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory		
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory		
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory		
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory		
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory		
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory	pulsory	
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory		
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics	s: Compulsory	
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics	s: Compulsory	
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Michatronics	s: Compulsory s: Compulsory ms Engineering: Comp	
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics	s: Compulsory s: Compulsory ms Engineering: Comp	
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Syster General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering So	cience
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Syster General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Syster General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering So	cience
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Syster General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering So ical Mechanical Engir	eerir
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Syster General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Syster General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering So ical Mechanical Engir	cience
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering Sc ical Mechanical Engir Development and Pro	eerir
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Ecompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Ecompulsory	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering Sc ical Mechanical Engir Development and Pro	eienc
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanical General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy System	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering Sc ical Mechanical Engir Development and Pro	eerir
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Syster General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoreti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Decompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syster Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syster Computer Science: Core qual	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering Sc ical Mechanical Engir Development and Pro	eerir
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanical General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanical General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Decompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syster Computer Science: Core qualification: Compulsory General Engineering Science (English program): Cor	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering Sc ical Mechanical Engir Development and Pro	eerir
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Syster General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretic Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syster Computer Science: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering Sc ical Mechanical Engir Development and Pro	eienc
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoreti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syster Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syster Com	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering Sc ical Mechanical Engir Development and Pro	eerir
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Syster General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Syster General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoreti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product E Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syster Computer Science: Core qua	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering Sc ical Mechanical Engir Development and Pro	eienc
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materia Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoreti Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syster Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syster Com	s: Compulsory ss: Compulsory ms Engineering: Comp als in Engineering Sc ical Mechanical Engir Development and Pro	eienc

Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

General Engineering Science and Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	ng	
Тур	Lecture	
Hrs/wk		
CP		
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Heiko Falk	
Language	DE	
Cycle	WiSe	
Content	Introduction Combinational Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output	
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005. 	

Course L0324: Computer Engineering	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0536: Fundament	tals of Fluid Mechanics			
Courses				
Title		Тур	Hrs/wk	СР
Fundamentals of Fluid Mechanics (L0091)		Lecture	2	4
Fluid Mechanics for Process Engineering		Recitation Section (large)	2	2
Module Responsible	Prof. Michael Schlüter			
Admission Requirements	None			
Recommended Previous	Mathematics I+II+III			
Knowledge	Technical Mechanics I+II			
	Technical Thermodynamics I+II			
	Working with force balances			
	Simplification and solving of partial differential equation	S		
	Integration			
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	Students are able to:			
	explain the difference between different types of flow			
	give an overview for different applications of the Reyno	ds Transport-Theorem in process engineeri	ina	
	explain simplifications of the Continuity- and Navier-Sto			
Skills	The students are able to			
	describe and model incompressible flows mathematica			
	 reduce the governing equations of fluid mechanics by s notice the dependency between theory and technical a 		is e.g. by integration	
	use the learned basics for fluid dynamical applications			
	add the realised success for half dynamical approach	g		
Personal Competence				
Social Competence	The students			
	 are capable to gather information from subject related, 	professional publications and relate that info	rmation to the contex	of the lecture and
	 able to work together on subject related tasks in small g 	roups. They are able to present their results	s effectively in English	(e.g. during small grou
	exercises)			
	are able to work out solutions for exercises by themselv	es, to discuss the solutions orally and to pre	sent the results.	
Autonomy	The students are able to			
•				
	search further literature for each topic and to expand the			
	 work on their exercises by their own and to evaluate the 	ir actual knowledge with the feedback.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	3 hours			
Assignment for the Following	General Engineering Science (German program): Specialisation	n Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation	•		
	General Engineering Science (German program, 7 semester): General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):			v
	Bioprocess Engineering: Core qualification: Compulsory		a50g. 00111pai301	,
	Energy and Environmental Engineering: Core qualification: Co	mpulsory		
	General Engineering Science (English program): Specialisatio	n Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisatio	n Energy and Enviromental Engineering: Co	ompulsory	
	General Engineering Science (English program): Specialisatio	n Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): \$			
	General Engineering Science (English program, 7 semester): \$			
	General Engineering Science (English program, 7 semester): \$		gineering: Compulsor	/
	Technomathematics: Specialisation III. Engineering Science: E Process Engineering: Core qualification: Compulsory	rective Compulsory		
	1 100633 Engineering. Our qualification. Compusory			



Course L0091: Fundamentals of Flui	id Mechanics
Тур	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Michael Schlüter
Language	DE
Cycle	SoSe
Content	fluid properties hydrostatic overall balances - theory of streamline overall balances- conservation equations differential balances - Navier Stokes equations irrotational flows - Potenzialströmungen flow around bodies - theory of physical similarity turbulent flows compressible flows
Literature	 Crowe, C. T.: Engineering fluid mechanics. Wiley, New York, 2009. Durst, F.: Strömungsmechanik: Einführung in die Theorie der Strömungen von Fluiden. Springer-Verlag, Berlin, Heidelberg, 2006. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994 Herwig, H.: Strömungsmechanik: Eine Einführung in die Physik und die mathematische Modellierung von Strömungen. Springer Verlag, Berlin, Heidelberg, New York, 2006 Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008 Kuhlmann, H.C.: Strömungsmechanik: München, Pearson Studium, 2007 Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2009 Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007 Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berlin, Heidelberg, 2008 Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006 van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882. White, F.: Fluid Mechanics, Mcgraw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011

Course L0092: Fluid Mechanics for I	Process Engineering
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Michael Schlüter
Language	DE
Cycle	SoSe
Content	In the exercise-lecture the topics from the main lecture are discussed intensively and transferred into application. For that, the students receive example tasks for download. The students solve these problems based on the lecture material either independently or in small groups. The solution is discussed with the students under scientific supervision and parts of the solutions are presented on the chalk board. At the end of each exercise-lecture, the correct solution is presented on the chalk board. Parallel to the exercise-lecture tutorials are held where the student solve exam questions under a set time-frame in small groups and discuss the solutions afterwards.
Literature	 Crowe, C. T.: Engineering fluid mechanics. Wiley, New York, 2009. Durst, F.: Strömungsmechanik: Einführung in die Theorie der Strömungen von Fluiden. Springer-Verlag, Berlin, Heidelberg, 2006. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994. Herwig, H.: Strömungsmechanik: Eine Einführung in die Physik und die mathematische Modellierung von Strömungen. Springer Verlag, Berlin, Heidelberg, New York, 2006. Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008. Kuhlmann, H.C.: Strömungsmechanik: München, Pearson Studium, 2007. Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2009. Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007. Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berlin, Heidelberg, 2008. Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006. van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882. White, F.: Fluid Mechanics, Mograw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011.



Module M0544: Phase Equ	ilibria Thermodynamics			
Courses				
Title		Тур	Hrs/wk	СР
Phase Equilibria Thermodynamics (L0114		Lecture	2	2
Phase Equilibria Thermodynamics (L0140		Recitation Section (small)	1	2
Phase Equilibria Thermodynamics (L0142		Recitation Section (large)	1	2
Module Responsible	Prof. Irina Smirnova			
Admission Requirements	None			
Recommended Previous	Mathematics, Physical Chemistry, Thermodynamics I and II			
Knowledge	, ,, ,,			
· ·				
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results		
Professional Competence	The maning part occossion, procedure nate to consider the tener			
Knowledge				
Mowieage	 Starting from the very basics of thermodynamics, the stu 	udents learn the mathematical tools to descri	ibe thermodynamic ed	quilibria.
	They learn how state variables are influenced by the mi	ixing of compounds and learn concepts to qu	uantitatively describe	these properties.
	Moreover, the students learn how phase equilibria can	be described mathematically and which pho	enomena may occur i	f different phases (vapor,
	liquid, solid) coexist in equilibrium. Furthermore the fund	damentals of reaction equilibria are taught.		
	For different phase equilibria, several examples relevant	nt for different kinds of processes are shown	and the necessary ki	nowledge for plotting and
	interpreting the equilibria are taught.			
Skills				
	Applying their knowledge, the students are able to ide	entify the correct equation for the determina	tion of the equilibriur	n state and know how to
	simplify these equations meaningfully.			
	The students know models which can be used to dete	rmine the properties of the system in the ed	quilibrium state and t	ney are able to solve the
	resulting mathematical relations.	To discount of the state of the		
	For specific applications, they are able to self-reliantly f	and necessary physico-chemical properties	of compounds as wel	i as modei parameters in
	literature sources.			
	Beside pure compound properties the students are cap The students have been the students are cap The students have been the students are cap. The students have been the students are cap.			
	The students know how to visualize phase equilibria graphs are shelf to a students are shelf to a students are shelf to a students.			
	Based on their knowledge, the students are able to processes in chamical appropriate.	understand lundamental concepts that are	the basis for many	separation and reaction
	processes in chemical engineering.			
Personal Competence				
Social Competence	The students are able to work in small groups, to solve the corr	responding problems and to present them or	aly to the tutors and o	ther students
Autonomy	The students are able to find necessary information self	f-reliantly in literature sources and to judge t	heir quality	
	During the semester the students are able to check the			wledge the students can
	adept their learning process.		-1. 20000 OH BIIO NIIC	ago aro otadorno cari
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes; theoretical questions and calculations			
	General Engineering Science (German program): Specialisation	on Process Engineering Compulsory		
Assignment for the Following		0 0 1 ,		
Curricula	General Engineering Science (German program): Specialisation		llcon.	
	General Engineering Science (German program, 7 semester):		•	
	General Engineering Science (German program, 7 semester):	opecialisation bioprocess Engineering: Cor	iipuisory	
	Bioprocess Engineering: Core qualification: Compulsory	n Bionrocco Engineering Commute		
	General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program): Specialisatio		loon	
	General Engineering Science (English program, 7 semester): S		•	
	General Engineering Science (English program, 7 semester): S	specialisation Bioprocess Engineering: Com	ipuisory	
	Process Engineering: Core qualification: Compulsory			



Course L0114: Phase Equilibria The	rmodynamics
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	SoSe
Content	
Literature	1. Introduction: Applications of thermodynamics of mixtures 2. Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity 3. Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule 4. Equations of state: virial equations, van-der-Waals equation, generalized equations of state 5. Mixing properties: ideal and real mixtures, excess properties, partial molar properties 6. Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition 7. Gas-liquid-equilibria: equilibrium condition, Henry-coefficient 8. GE-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC 9. Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems 10. Solid-liquid-equilibria: equilibrium condition, binary systems 11. Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature 12. Osmotic pressure
Literature	 Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997.J.P. O'Connell, J.M. Haile: Thermodynamics. Cambridge University Press, 2005.

Course L0140: Phase Equilibria The	rmodynamics
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	SoSe
Content	1. Introduction: Applications of thermodynamics of mixtures 2. Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity 3. Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule 4. Equations of state: virial equations, van-der-Waals equation, generalized equations of state 5. Mixing properties: ideal and real mixtures, excess properties, partial molar properties 6. Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition 7. Gas-liquid-equilibria: equilibrium condition, Henry-coefficient 8. GE-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC 9. Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems 10. Solid-liquid-equilibria: equilibrium condition, binary systems 11. Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature 12. Osmotic pressure The students work on tasks in small groups and present their results in front of all students.
Literature	 Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997.J.P. O'Connell, J.M. Haile: Thermodynamics Cambridge University Press, 2005.



Course L0142: Phase Equilibria Thermodynamics		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	SoSe	
Content	1. Introduction: Applications of thermodynamics of mixtures 2. Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity 3. Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule 4. Equations of state: virial equations, van-der-Waals equation, generalized equations of state 5. Mixing properties: ideal and real mixtures, excess properties, partial molar properties 6. Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition 7. Gas-liquid-equilibria: equilibrium condition, Henry-coefficient 8. GE-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC 9. Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems 10. Solid-liquid-equilibria: equilibrium condition, binary systems 11. Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature 12. Osmotic pressure	
Literature	 Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997.J.P. O'Connell, J.M. Haile: Thermodynamics. Cambridge University Press, 2005. 	



ourses				
tle		Тур	Hrs/wk	СР
gnals and Systems (L0432)		Lecture	3	4
gnals and Systems (L0433)		Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch			
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge	The modul is an introduction to the theory of signals and sy	stems. Good knowledge in maths as covere	d by the moduls Mat	hematik 1-3 is exped
	Further experience with spectral transformations (Fourier seri			
Educational Objectives	After taking part successfully, students have reached the following	wing learning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and li	near time-invariant (LTI) systems using metho	ods of signal and syste	em theory. They are
	to apply the fundamental transformations of continuous-time			
	and systems mathematically in both time and image domain		in time domain and in	mage domain which
	caused by the transition of a continuous-time signal to a discr			
Skills	The students are able to describe and analyse deterministic			
	can analyse and design basic systems regarding important		ponse, stability, linear	ity etc They can as
	the impact of LTI systems on the signal properties in time and	frequency domain.		
Personal Competence				
Social Competence	The students can jointly solve specific problems.		and disable to the state	isas a resident
Autonomy	The students are able to acquire relevant information from a	•••	roi their level of know	riedge during the lea
*** ** ** **	period by solving tutorial problems, software tools, clicker sys	em.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisa			
Curricula	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program): Specialisa		mpulsory	
	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program, 7 semester)			
	General Engineering Science (German program, 7 semester)			
	General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semester)			
	General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semester)		. ,	
	General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semester)			moulcone
	General Engineering Science (German program, 7 semester)			
	General Engineering Science (German program, 7 semester)			
	General Engineering Science (German program, 7 semester)			
	Compulsory	ser). Opeoidisation Mediamodi Engineering	g, rodds Materials III	Linginicening colon
	General Engineering Science (German program, 7 semester	: Specialisation Mechanical Engineering, Foo	cus Mechatronics: Cor	npulsorv
	General Engineering Science (German program, 7 semes			
	Compulsory	, Jacob moderning		
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisat	ion Civil- and Enviromental Engeneering: Cor	mpulsory	
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program): Specialisat	ion Computer Science: Compulsory		
	General Engineering Science (English program): Specialisat	ion Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisat	ion Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisat	ion Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester)	: Specialisation Electrical Engineering: Comp	ulsory	
	General Engineering Science (English program, 7 semester)	: Specialisation Computer Science: Compulso	ory	
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semes	ter): Specialisation Mechanical Engineering	g, ⊢ocus Materials in	Engineering Scien
	Compulsory	Consisting Machanial Full Control	ua Maakataaa'aa O	anulaan:
	General Engineering Science (English program, 7 semester) General Engineering Science (English program, 7 semest			
		eri: Specialisation Mechanical Engineering.	. ⊢ocus Ineoretical N	nechanical Enginee
		and the second s		noonamoar Enginee
	Compulsory Computational Science and Engineering: Core qualification:	, ,		noonamear Enginee



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle Content	SoSe
	Basic classification and description of continuous-time and discrete-time signals and systems Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)
	Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

Course L0433: Signals and Systems	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Courses Title				
		Тур	Hrs/wk	CP
Bioprocess Engineering - Fundamentals (L084		Lecture	2	3
Bioprocess Engineering- Fundamentals (L084		Recitation Section (large)	2	1
Bioprocess Engineering - Fundamental Praction		Laboratory Course	2	2
	rof. Andreas Liese			
·	one			
	one, module "organic chemistry", module "fundamen	tals for process engineering"		
Knowledge				
	ter taking part successfully, students have reached the	he following learning results		
Professional Competence				
	udents are able to describe the basic concepts o			
	icroorganisms, as well as to differentiate different type			
pro	ocesses in bioreactors can be explained. The stud	dents are capable to explain fundamental bioproc	cess management, ste	erilization technology
do	ownstream processing in detail.			
Skills Af	ter successful completion of this module, students sh	nould be able to		
	• • • • • • • • • • • • • • • • • • • •	h and substrate-uptake and to calculate the corresp		
		neration, regeneration of redox equivalents and gro	wth inhibition on the fe	ermentation process
	analyze bioprocesses on basis of stoichiometry	•		
	 distinguish between scale-up criteria for different 	ent bioreactors and bioprocesses (anaerobic, aerob	oic as well as microaer	obic) to compare ther
	well as to apply them to current biotechnical pr	oblem		
	 propose solutions to complicated biotechnolog 	ical problems and to deduce the corresponding mo	odels	
	to explore new knowledge resources and to ap	only the newly gained contents		
	identify scientific problems with concrete indus			
	to document and discuss their procedures as well			
Personal Competence				
	ter completion of this module participants should be	e able to debate technical questions in small team	s to enhance the abili	ty to take position to
· ·	vn opinions and increase their capacity for teamwork		s to crimarioe the abin	ty to take position to
O.	vir opinions and increase their capacity for teamwork	thir engineering and scientific environments.		
Autonomy Af	ter completion of this module participants will be a	able to solve a technical problem in a team indep	pendently by organizi	ng their workflow and
pro	esent their results in a plenum.			
Wouldood in House In	descendent Chidu Timo OC Chidu Timo in Lenture OA			
	dependent Study Time 96, Study Time in Lecture 84			
	ritten exam			
) min			
	eneral Engineering Science (German program): Spe	egialisation Process Engineering: Compulsory		
	eneral Engineering Science (German program): Spe			
	eneral Engineering Science (German program, 7 se		nuleony	
	eneral Engineering Science (German program, 7 sei		•	
	oprocess Engineering: Core qualification: Compulso	, ,	Impulsory	
		•		
	eneral Engineering Science (English program): Sper eneral Engineering Science (English program): Sper			
			uleony	
	eneral Engineering Science (English program, 7 ser		-	
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory			
Ge		as and Danas and him Madistree Committee		
Ge Bir	omedical Engineering: Specialisation Artificial Organ			
Ge Bir Bir	omedical Engineering: Specialisation Artificial Organomedical Engineering: Specialisation Implants and	Endoprostheses: Elective Compulsory		
Ge Bi Bi Bie	omedical Engineering: Specialisation Artificial Orga omedical Engineering: Specialisation Implants and omedical Engineering: Specialisation Medical Tech	Endoprostheses: Elective Compulsory nology and Control Theory: Elective Compulsory		
Ge Bi Bi Bi	omedical Engineering: Specialisation Artificial Organomedical Engineering: Specialisation Implants and	Endoprostheses: Elective Compulsory nology and Control Theory: Elective Compulsory and Business Administration: Elective Compulsory		



Course L0841: Bioprocess Enginee	ring - Fundamentals
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Andreas Liese, Prof. An-Ping Zeng
Language	DE
Cycle	SoSe
Content	 Introduction: state-of-the-art and development trends in the biotechnology, introduction to the lecture Enzyme kinetics: Michaelis-Menten, differnt types of enzyme inhibition, linearization, conversion, yield, selectivity (Prof. Liese) Stoichiometry: coefficient of respiration, electron balance, degree of reduction, coefficient of yield, theoretical oxygen demand (Prof. Liese) Microbial growth kinetic: batch- and chemostat culture (Prof. Zeng) Kinetic of subtrate consumption and product formation (Prof. Zeng) Rheology: non-newtonian fluids, viscosity, agitators, energy input (Prof. Liese) Transport process in a bioreactor (Prof. Zeng) Technology of sterilization (Prof. Zeng) Fundamentals of bioprocess management: bioreactors and calculation of batch, fed-batch and continuouse bioprocesses (Prof. Zeng/Prof. Liese) Downstream technology in biotechnology: cell breakdown, zentrifugation, filtration, aqueous two phase systems (Prof. Liese)
Literature	K. Buchholz, V. Kasche, U. Bornscheuer: Biocatalysts and Enzyme Technology, 2. Aufl. Wiley-VCH, 2012 H. Chmiel: Bioprozeßtechnik, Elsevier, 2006 R.H. Balz et al.: Manual of Industrial Microbiology and Biotechnology, 3. edition, ASM Press, 2010 H.W. Blanch, D. Clark: Biochemical Engineering, Taylor & Francis, 1997 P. M. Doran: Bioprocess Engineering Principles, 2. edition, Academic Press, 2013

Course L0842: Bioprocess Engineering- Fundamentals	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Andreas Liese, Prof. An-Ping Zeng
Language	DE
Cycle	SoSe
Content	1. Introduction (Prof. Liese, Prof. Zeng)
	2. Enzymatic kinetics (Prof. Liese)
	3. Stoichiometry I + II (Prof. Liese)
	4. Microbial Kinetics I+II (Prof. Zeng)
	5. Rheology (Prof. Liese)
	6. Mass transfer in bioprocess (Prof. Zeng)
	7. Continuous culture (Chemostat) (Prof. Zeng)
	8. Sterilisation (Prof. Zeng)
	9. Downstream processing (Prof. Liese)
	10. Repetition (Reserve) (Prof. Liese, Prof. Zeng)
Literature	siehe Vorlesung

Course L0843: Bioprocess Engineering - Fundamental Practical Course		
Тур	Laboratory Course	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Andreas Liese, Prof. An-Ping Zeng	
Language	DE	
Cycle	SoSe	
Content	In this course fermentation and downstream technologies on the example of the production of an enzyme by means of a recombinant microorganism is learned. Detailed characterization and simulation of enzyme kinetics as well as application of the enzyme in a bioreactor is carried out. The students document their experiments and results in a protocol.	
Literature	Skript	



Module M0538: Heat and M	lass Transfer			
Courses				
Title		Тур	Hrs/wk	СР
Heat and Mass Transfer (L0101)		Lecture	2	2
Heat and Mass Transfer (L0102)		Recitation Section (small)	1	2
Heat and Mass Transfer (L1868)		Recitation Section (large)	1	2
Module Responsible				
Admission Requirements	None			
Recommended Previous Knowledge	Basic knowledge: Technical Thermodynamics			
Knowleage				
Educational Objectives	After taking part successfully, students have reached the followin	a learning results		
Professional Competence	, and the same of	,		
Knowledge				
	The students are capable of explaining qualitative and	determining quantitative heat transfer in	procedural apparatu	s (e. g. heat exchanger
	chemical reactors).They are capable of distinguish and characterize differer	t kinde of heat transfer mechanisms name	alv heat conduction h	neat transfer and therma
	radiation.	t kinds of freat transfer free trains its frame	ery rieat coriduction, i	ieat transier and trienna
	The students have the ability to explain the physical basis	for mass transfer in detail and to describe	e mass transfer qualit	tative and quantitative by
	using suitable mass transfer theories.		•	
	They are able to depict the analogy between heat- and m	ass transfer and to describe complex linke	d processes in detail.	
Skills				
	The students are able to set reasonable system boundary.	ries for a given transport problem by usin	ng the gained knowle	edge and to balance the
	corresponding energy and mass flow, respectively.	o (o a booted shaminal reactors tomper	atura altaration in flu	ida) and to calculate the
	 They are capable to solve specific heat transfer problem corresponding heat flows. 	is (e.g. neated chemical reactors, temper	ature atteration in itu	ids) and to calculate the
	Using dimensionless quantities, the students can execute	scaling up of technical processes or appa	aratus.	
	They are able to distinguish between diffusion, convecting			ledge for the description
	and design of apparatus (e.g. extraction column, rectificat			
	In this context, the students are capable to choose an	d design fundamental types of heat and	d mass exchanger fo	or a specific application
	considering their advantages and disadvantages, respect	ively.		
	In addition, they can calculate both, steady-state and non-	steady-state processes in procedural app	aratus.	
	The students are capable to connect their knowledge	obtained in this course with knowlegd	e of other courses (I	n particular the courses
	thermodynamics, fluid mechanics and chemical process of	ngineering) to solve concrete technical pr	oblems.	
Personal Competence				
Social Competence				
occidi competense	The students are capable to work on subject-specific characteristics.	llenges in teams and to present the resul	ts orally in a reasona	ble manner to tutors and
	other students.			
Autonomy	The students are able to find and evaluate necessary info	rmation from suitable sources		
	They are able to prove their level of knowledge during	g the course with accompanying proce	dure continuously (c	licker-system, exam-like
	assignments) and on this basis they can control their lear	ning processes.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points				
Examination	Written exam			
Examination duration and scale	120 minutes; theoretical questions and calculations			
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp		•	
	General Engineering Science (German program, 7 semester): Sp. General Engineering Science (German program, 7 semester): Sp.			v
	Bioprocess Engineering: Core qualification: Compulsory	3.97 and announced Ent	, g	•
	Energy and Environmental Engineering: Core qualification: Com	oulsory		
	General Engineering Science (English program): Specialisation	Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation	Energy and Enviromental Engineering: Co	mpulsory	
	General Engineering Science (English program): Specialisation	Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Sp	ecialisation Process Engineering: Comput	sory	
General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory		, , , , , ,		
	General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory			
			ineering: Compulsory	/
	Technomathematics: Specialisation III. Engineering Science: Ele		ineering: Compulsory	/
			ineering: Compulsory	/



Course L0101: Heat and Mass Transfer	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	1. Heat transfer Introduction, one-dimensional heat conduction Convective heat transfer Multidimensional heat conduction Non-steady heat conduction Thermal radiation Mass transfer one-way diffusion, equimolar countercurrent diffusion boundary layer theory, non-steady mass transfer Heat and mass transfer single particle/ fixed bed Mass transfer and chemical reactions
Literature	H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer VDI-Wärmeatlas

Course L0102: Heat and Mass Trans	Course L0102: Heat and Mass Transfer	
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

ourse L1868: Heat and Mass Transfer	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0546: Thermal Se	eparation Processes			
Courses				
Title		Тур	Hrs/wk	СР
Thermal Separation Processes (L0118)		Lecture	2	2
Thermal Separation Processes (L0119)		Recitation Section (small)	2	2
Thermal Separation Processes (L0141)		Recitation Section (large)	1	1
Separation Processes (L1159)		Laboratory Course	1	1
Module Responsible	Prof. Irina Smirnova			
Admission Requirements	None			
Recommended Previous Knowledge	Recommended requirements: Thermodynamics III			
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	The students can distinguish and describe different types The students develop an understanding for the course o process, the possibilities of energy saving, and the selecti They have good knowledge of designing methods for sep	f concentration during a separation proce on of separation systems		
Skills	Using the gained knowledge the students can select a reasonable system boundary for a given separation process and can close the associate energy and material balances The students can use different graphical methods for the designing of a separation process and define the amount of theoretical stages require They can select and design a basic type of thermal separation process for a given case based on the advantages and disadvantages of the process The students are capable to obtain independently the needed material properties from appropriate sources (diagrams and tables) They can calculate continuous and discontinuous processes The students are able to prove their theoretical knowledge in the experimental lab work. The students are able to discuss the theoretical background and the content of the experimental work with the teachers in colloquium. The students are capable of linking their gained knowledge with the content of other lectures and use it together for the solution of technical problem. Other lectures such as thermodynamics, fluid mechanics and chemical engineering.		pretical stages required and disadvantages of the disadvantages of the disadvantages of the disadvantages.	
Personal Competence Social Competence	The students can work technical assignments in small gro The students are able to carry out practical lab work in si			n them. They are able to
	discuss their results and to document them scientifically in		ision of labor betwee	ir triem. They are able to
	allocation recents and to accument them esternished y	a lopolu		
Autonomy	The students are capable to obtain the needed informatio The students can proof the state of their knowledge with e	•		ing process
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes; theoretical questions and calculations			
Assignment for the Following	General Engineering Science (German program): Specialisation	Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation		ompulsory	
	General Engineering Science (German program, 7 semester): Sp	•		
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp			у
	Bioprocess Engineering: Core qualification: Compulsory	a	,gp	,
	Energy and Environmental Engineering: Core qualification: Comp	pulsory		
	General Engineering Science (English program): Specialisation I	•		
	General Engineering Science (English program): Specialisation I		mnulsory	
	General Engineering Science (English program): Specialisation I	• •	травоту	
			sorv	
	General Engineering Science (English program, 7 semester): Sp.			
	General Engineering Science (English program, 7 semester): Sp.			,
	General Engineering Science (English program, 7 semester): Spi	Solansation Energy and Environmental Eng	g. Gorilpuisor)	,
	Process Engineering: Core qualification: Compulsory			



Course L0118: Thermal Separation	1 Processes
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	Introduction in the thermal process engineering and to the main features of separation processes imple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann"s Enzyklopädie der Technischen Chemie



Course L0119: Thermal Separation	Processes
Тур	Recitation Section (small)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes Selection of separation processes The students work on tasks in small groups and present their results in front of all students.
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann's Enzyklopädie der Technischen Chemie



Course L0141: Thermal Separation	Processes
Тур	Recitation Section (large)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann"s Enzyklopädie der Technischen Chemie



Course L1159: Separation Process	es
Тур	Laboratory Course
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Course work	Compulsory attendence of the colloquia of all experiments and compulsory report.
Lecturer	Prof. Irina Smirnova
Language	DE/EN
Cycle	SoSe
Content	The students work on eight different experiments in this practical course. For every one of the eight experiments, a colloquium takes place in which the
	students explain and discuss the theoretical background and its translation into practice with staff and fellow students.
	The students work small groups with a high degree of division of labor. For every experiment, the students write a report. They receive instructions in terms of scientific writing as well as feedback on their own reports and level of scientific writing so they can increase their capabilities in this area.
	Topics of the practical course:
	Introduction in the thermal process engineering and to the main features of separation processes
	Simple equilibrium processes, several steps processes
	Distillation of binary mixtures, enthalpy-concentration diagrams
	Extractive and azeotrope distillation, water vapor distillation, stepwise distillation
	Extraction: separation ternary systems, ternary diagram
	Multiphase separation including complex mixtures
	Designing of separation devices without discrete stages
	• Drying
	Chromatographic separation processes
	Membrane separation Energy demand of separation processes
	Advance overview of separation processes
	Selection of separation processes
	Gelection of separation processes
Literature	G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980
	Sattler: Thermische Trennverfahren, VCH, Weinheim 1995
	J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998.
	Mersmann: Thermische Verfahrenstechnik, Springer, 1980
	Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997
	Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopf
	Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1 ; ISBN 0-387-91477-3 .
	R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006.
	 Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann" Enzyklopädie der Technischen Chemie



Module M0892: Chemical R	eaction Engineering			
Courses				
Title		Тур	Hrs/wk	CP
Chemical Reaction Engineering (Fundame	ntals) (L0204)	Lecture	2	2
Chemical Reaction Engineering (Fundame	ntals) (L0244)	Recitation Section (large)	2	2
Experimental Course Chemical Engineering	g (Fundamentals) (L0221)	Laboratory Course	2	2
Module Responsible	Prof. Raimund Horn			
Admission Requirements	None			
Recommended Previous	Contents of the previous modules mathematics I-III, physical c	hemistry, technical thermodynamics I+II as w	ell as computational r	nethods for engineers.
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	The students are able to explain basic concepts of chemical r	reaction engineering. They are able to point	out differences betwe	en thermodynamical and
	kinetical processes. The students have a strong ability to outlin	ne parts of isothermal and non-isothermal ide	al reactors and to des	scribe their properties.
Skills	After successful completion of the module, students are able to	0:		
	- apply different computational methods to dimension isothern	nal and non-isothermal ideal reactors,		
	- determine and compute stable operation points for these rea	ictors ,		
	- conduct experiments on a lab-scale pilot plants and docume	nt these according to scientific guidelines.		
Personal Competence				
Social Competence	After successful completition of the lab-course the students	have a strong ability to organize themselfes	s in small groups to	solve issues in chemical
	reaction engineering. The students can discuss their subject re	elated knowledge among each other and wit	h their teachers.	
Autonomy	The students are able to obtain further information and asse	ess their relevance autonomously. Students	can apply their know	rldege discretely to plan,
	prepare and conduct experiments.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisati	ion Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisati	ion Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester):	: Specialisation Process Engineering: Compu	ilsory	
	General Engineering Science (German program, 7 semester):	: Specialisation Bioprocess Engineering: Cor	npulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation	on Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation	on Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester):	Specialisation Process Engineering: Compu	Isory	
	General Engineering Science (English program, 7 semester):	Specialisation Bioprocess Engineering: Con	pulsory	
	Process Engineering: Core qualification: Compulsory			

Course L0204: Chemical Reaction E	engineering (Fundamentals)
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Raimund Horn
Language	DE
Cycle	WiSe
Content	Fundamentals of chemical reaction engineering, definitions, calculation of species concentrations (reactor, reaction mixture, reactants, products, inerts and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentration, mass-concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, conversion, selectivity, yield, concentration calculations in stationary and flowing multicomponent-mixtures)
	Stoichiometry and stoichiometric calculations (simple reactions, complex reactions, key reactions, key species, matrix of stoichiometric coefficients, linear dependent and independent reactions, element-species-matrix, row reduced form of a matrix, rank of a matrix, Gauss Jordan elimination, relation between stoichiometry and kinetics, calculating the extent of reaction from mole number changes in complex reactions)
	Thermodynamics (What is thermodynamics?, importance of thermodynamics in chemical reaction engineering, zeroth law of thermodynamics temperature scales, temperature measurements in praxis, first law of thermodynamics, internal energy, enthalpy, calorimeter, heat of reaction, standard heat of formation, Hess law, heat capacity, Kirchhoff law, standard heat of reaction, pressure dependence of the heat of reaction, second law of thermodynamics, reversible and irreversible processes, entropy, Clausius inequality, free energy, Gibbs Energy, chemical potential, chemical equilibrium, activity, van't Hoff law, calculation of chemical equilibrium, principle of Le Chatelier and Braun, equilibrium calculations in multiple reaction systems, Lagrange Multipliers)
	Chemical kinetics (reversible and irreversible reactions, homogeneous and heterogeneous reactions, elementary step, reaction mechanism microkinetics, macrokinetics, formal kinetics, reaction rate, rate of change of species mole number, Arrhenius-equation, activation energy and pre-exponential factor for komplex reactions, reactions of 0., 1. and 2. order, analytical integration of rate laws, Damköhler-number, differential and integral method of kinetic analysis, laboratory reactors for kinetic measurements, half life, kinetics of complex reactions, parallel reactions, reversible reactions sequence of reactions, irreversible reaction with pre-equilibrium, reduction of reaction mechanisms, quasi-stationarity principle of Bodenstein, rate limiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of complex kinetics)
	Types of chemical Reaktors (chemical reactors in industry and laboratory, ideal vs. real reaktors, discontinuous, half continuous and continuous reactors



single phase - biphasic- and multiphase reactors, batch-reactor, semi-batch reactor, CSTR, Plug Flow reactor, fixed bed reactor, adiabatic staged reactors, rotating furnaces, fluidized bed reactors, gas-liquid-reactors, multi-phase reactors)

Isothermal ideal reactors (mole-balance of a chemical reactor, mole balance of a batch reactor, integration of the batch reactor mole balance for various kinetics, partial fraction decomposition, mole balance of the semi-batch reactor, mole balance of the plug flow reactor, analogy batch reactor - plug flow reactor, design of plug flow reactors for reactions with volume change and complex reactions, mole balance of a fixed bed reactor, design of a membrane reactor, mole balance of a continuously stirred tank reactor, comparison of CSTR and PFR with respect to conversion and selectivity, mole-balance of a cascade of tank reactors, numerical-interative calculation of a cascade of tank reactors, Newton-Raphson method, graphical analysis of a cascade of tank reactors)

non-isothermal ideal reactors (energy balance of a reactor, adiabatic reactor, adiabatic temperature rise, staged reactor for adiabatic exothermic reactions limited by chemical equilibrium, design of an adiabatic plug flow reactor, Levenspiel-plots, heat transfer through a reactor wall, heat transfer by convection, heat conduction, heat transfer through a cylindrical wall, design of a plug flow reactor in parallel and counter flow, heat balance of the cooling fluid, CSTR with heat exchange, multiple stationary states, ignition-extinction behavior, stability of a CSTR, complex reactions in non-isothermal reactors, optimum temperature profile of a reactor)

Literature

lecture notes Raimund Horn

skript Frerich Keil

Books:

- M. Baerns, A. Behr, A. Brehm, J. Gmehling, H. Hofmann, U. Onken, A. Renken, Technische Chemie, Wiley-VCH
- G. Emig, E. Klemm, Technische Chemie, Springer
- A. Behr, D. W. Agar, J. Jörissen, Einführung in die Technische Chemie
- E. Müller-Erlwein, Chemische Reaktionstechnik 2012, 2. Auflage, Teubner Verlag
- J. Hagen, Chemiereaktoren: Auslegung und Simulation, 2004, Wiley-VCH
- H. S. Fogler, Elements of Chemical Reaction Engineering, Prentice Hall B
- $\hbox{H.\,S.\,Fogler,\,Essentials\,of\,Chemical\,\,Reaction\,\,Engineering,\,Prentice\,\,Hall}$
- O. Levenspiel, Chemical Reaction Engineering, John Wiley & Sons, 1998
- L. D. Schmidt, The Engineering of Chemical Reactions, Oxford Univ. Press, 2009
- J. B. Butt, Reaction Kinetics and Reactor Design, 2000, Marcel Dekker
- R. Aris, Elementary Chemical Reactor Analysis, Dover Pubn. Inc., 2000
- $\hbox{M.\,E.\,Davis,\,R.\,J.\,Davis,\,Fundamentals\,of\,Chemical\,\,Reaction\,\,Engineering,\,McGraw\,\,Hill}$
- G. F. Froment, K. B. Bischoff, J. De Wilde, Chemical Reactor Analysis and Design, John Wiley & Sons, 2010
- A. Jess, P. Wasserscheid, Chemical Technology An Integrated Textbook, WILEY-VCH



rse L0244: Chemical Reaction E	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Raimund Horn, Dr. Oliver Korup
Language	DE
Cycle	WiSe
Content	Fundamentals of chemical reaction engineering, definitions, calculation of species concentrations (reactor, reaction mixture, reactants, products, in and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, conversions violated expectations calculations in stationary and flowing multicomponent mixtures).
	selectivity, yield, concentration calculations in stationary and flowing multicomponent-mixtures) Stoichiometry and stoichiometric calculations (simple reactions, complex reactions, key reactions, key species, matrix of stoichiometric coefficients, lid dependent and independent reactions, element-species-matrix, row reduced form of a matrix, rank of a matrix, Gauss Jordan elimination, relabetween stoichiometry and kinetics, calculating the extent of reaction from mole number changes in complex reactions)
	Thermodynamics (What is thermodynamics?, importance of thermodynamics in chemical reaction engineering, zeroth law of thermodynamics temperature scales, temperature measurements in praxis, first law of thermodynamics, internal energy, enthalpy, calorimeter, heat of reaction, standheat of formation, Hess law, heat capacity, Kirchhoff law, standard heat of reaction, pressure dependence of the heat of reaction, second law thermodynamics, reversible and irreversible processes, entropy, Clausius inequality, free energy, Gibbs Energy, chemical potential, chen equilibrium, activity, van't Hoff law, calculation of chemical equilibrium, principle of Le Chatelier and Braun, equilibrium calculations in multiple reactions, second law thermodynamics.
	Chemical kinetics (reversible and irreversible reactions, homogeneous and heterogeneous reactions, elementary step, reaction mechan microkinetics, macrokinetics, formal kinetics, reaction rate, rate of change of species mole number, Arrhenius-equation, activation energy and exponential factor for komplex reactions, reactions of 0., 1. and 2. order, analytical integration of rate laws, Damköhler-number, differential and inte method of kinetic analysis, laboratory reactors for kinetic measurements, half life, kinetics of complex reactions, parallel reactions, reversible reacti sequence of reactions, irreversible reaction with pre-equilibrium, reduction of reaction mechanisms, quasi-stationarity principle of Bodenstein, limiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of com kinetics)
	Types of chemical Reaktors (chemical reactors in industry and laboratory, ideal vs. real reaktors, discontinuous, half continuous and continuous reacting phase - biphasic- and multiphase reactors, batch-reactor, semi-batch reactor, CSTR, Plug Flow reactor, fixed bed reactor, adiabatic star reactors, rotating furnaces, fluidized bed reactors, gas-liquid-reactors, multi-phase reactors)
	Isothermal ideal reactors (mole-balance of a chemical reactor, mole balance of a batch reactor, integration of the batch reactor mole balance for variations, partial fraction decomposition, mole balance of the semi-batch reactor, mole balance of the plug flow reactor, analogy batch reactor - plug reactor, design of plug flow reactors for reactions with volume change and complex reactions, mole balance of a fixed bed reactor, design membrane reactor, mole balance of a continuously stirred tank reactor, comparison of CSTR and PFR with respect to conversion and selectivity, in balance of a cascade of tank reactors, numerical-interative calculation of a cascade of tank reactors, Newton-Raphson method, graphical analysis cascade of tank reactors)
	non-isothermal ideal reactors (energy balance of a reactor, adiabatic reactor, adiabatic temperature rise, staged reactor for adiabatic exother reactions limited by chemical equilibrium, design of an adiabatic plug flow reactor, Levenspiel-plots, heat transfer through a reactor wall, heat transfer convection, heat conduction, heat transfer through a cylindrical wall, design of a plug flow reactor in parallel and counter flow, heat balance o cooling fluid, CSTR with heat exchange, multiple stationary states, ignition-extinction behavior, stability of a CSTR, complex reactions in non-isother reactors, optimum temperature profile of a reactor)
Literature	lecture notes Raimund Horn
	skript Frerich Keil
	Books:
	M. Baerns, A. Behr, A. Brehm, J. Gmehling, H. Hofmann, U. Onken, A. Renken, Technische Chemie, Wiley-VCH
	G. Emig, E. Klemm, Technische Chemie, Springer
	A. Behr, D. W. Agar, J. Jörissen, Einführung in die Technische Chemie
	E. Müller-Erlwein, Chemische Reaktionstechnik 2012, 2. Auflage, Teubner Verlag
	J. Hagen, Chemiereaktoren: Auslegung und Simulation, 2004, Wiley-VCH
	H. S. Fogler, Elements of Chemical Reaction Engineering, Prentice Hall B
	H. S. Fogler, Essentials of Chemical Reaction Engineering, Prentice Hall
	O. Levenspiel, Chemical Reaction Engineering, John Wiley & Sons, 1998
	L. D. Schmidt, The Engineering of Chemical Reactions, Oxford Univ. Press, 2009
	J. B. Butt, Reaction Kinetics and Reactor Design, 2000, Marcel Dekker
	R. Aris, Elementary Chemical Reactor Analysis, Dover Pubn. Inc., 2000
	M. E. Davis, R. J. Davis, Fundamentals of Chemical Reaction Engineering, McGraw Hill
	G. F. Froment, K. B. Bischoff, J. De Wilde, Chemical Reactor Analysis and Design, John Wiley & Sons, 2010
	A. Jess, P. Wasserscheid, Chemical Technology An Integrated Textbook, WILEY-VCH



Course L0221: Experimental Course	e Chemical Engineering (Fundamentals)
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Raimund Horn, Dr. Achim Bartsch
Language	DE/EN
Cycle	SoSe
Content	Performing and evaluation of experiments concerning chemical reaction engineering with emphasis on ideal reactors:
	* Batch reactor - Estimation of kinetic parameters for the saponification of ethylacetate
	*CSTR - Residence time distribution, reaction
	*CSTR in Series - Residence time distribution, reaction
	* Plug Flow Reactor - Residence time distribution, reaction
	Before the practical conduct of the experiments a colloquium takes place in which the students explain, reflect and discuss the theoretical basics and their translation into practice.
	The students write up a report for every experiment. They receive feedback to their level of scientific writing (citation methods, labeling of graphs, etc.), so that they can improve their competence in this field over the course of the practical course.
Literature	Levenspiel, O.: Chemical reaction engineering; John Wiley & Sons, New York, 3. Ed., 1999 VTM 309(LB)
	Praktikumsskript
	Skript Chemische Verfahrenstechnik 1 (F.Keil)



	ent Technology for Mechanical and Process E				
Courses					
Title		Тур	Hrs/wk	СР	
Practical Course: Measurement and Contr	rol Systems (L1119)	Laboratory Course	2	2	
Measurement Technology for Mechanical	and Process Engineers (L1116)	Lecture	2	3	
Measurement Technology for Mechanical	and Process Engineers (L1118)	Recitation Section (large)	1	1	
Module Responsible	Dr. Sven Krause				
Admission Requirements	none				
Recommended Previous	Basic knowledge of physics, chemistry and electrical engineeri	ng			
Knowledge					
Educational Objectives	After taking part successfully, students have reached the follow	ng learning results			
Professional Competence					
Knowledge	Students are able to name the most important fundmentals of	the Measurement Technology (Quantities	and Units, Uncertainty	, Calibration, Static	
	Dynamic Properties of Sensors and Systems).				
	They can cutting the most important massuring methods for di	forest kinds of quantities to be massured.	Electrical Quantities	Famparatura maahan	
	They can outline the most important measuring methods for dis	lerent kinds of quantities to be maesured (Electrical Quantities,	remperature, mechan	
	quantities, Flow, Time, Frequency).				
	They can describe important methods of chemical Analysis (Ga	s Sensors, Spectroscopy, Gas Chromatogi	raphy)		
Skills	Students can select suitable measuring methods to given probl	ems and can use refering measurement de	evices in practice.		
	The students are able to orally explain issues in the subject area of measurement technology and solution approaches as well as place the issues in				
	the right context and application area.				
Personal Competence					
Social Competence	Students can arrive at work results in groups and document the	m in a common report.			
	Substitute at Article and Arti				
Autonomy	Students are able to familiarize themselves with new measurer	nent technologies.			
		-			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70				
Credit points	6				
Examination	Written exam				
Examination duration and scale	105 minutes				
Assignment for the Following	General Engineering Science (German program): Specialisation		Compulsory		
Curricula	General Engineering Science (German program): Specialisation				
	General Engineering Science (German program): Specialisation				
	General Engineering Science (German program): Specialisation				
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory				
	General Engineering Science (German program, 7 semester):				
	General Engineering Science (German program, 7 semester):				
	General Engineering Science (German program, 7 semester):		ulsory		
	Energy and Environmental Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation		aine oring (Commuter		
	General Engineering Science (English program, 7 semester): S			у	
	General Engineering Science (English program, 7 semester): S				
	General Engineering Science (English program, 7 semester): S				
	General Engineering Science (English program, 7 semester): S Mechanical Engineering: Core qualification: Compulsory	pedansandn Frocess Engineering: Compi	uisofy		
	Mechatronics: Core qualification: Compulsory Mechatronics: Core qualification: Compulsory				
	weenauonics. Oure qualification. Compuisory				



automotive exhaust are used. Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated. starting will be simulated on a PC and compared with measurement. Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michel interferometer and optical fibers demonstrated. Experiment 4:Identification of the parameters of a control system and optimal control parameters Literature Versuch 1: Lieith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftli Verlagsgesellschaft, Stuttgart, 1974	Course L1119: Practical Course: Me	easurement and Control Systems
Workload in Nours Lecture Language DE Oycle WissasSas Content Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants automotive exhaust are used. Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated: starting will be simulated on a PC and compared with measurement. Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michel interferometer and optical fibers demonstrated. Experiment 4:identification of the parameters of a control system and optimal control parameters Literature Versuch 1: • Leith, W: Die Analyse der Lut und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2: Aufl., Wissenschaftli Verlagsgesellschaft, Stuttgart. 1974 • Either M. Mettechnik für den Immissionsschutz, Messen der gas- und partikelförnigen Luthverunreinigungen. R. Oldenburg Verlag, Münch Wen, 1979 • Lutbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung • Gebrauchs- und Bedienungsanweisungen • VDH-Handbuch Reinhaltung der Lutt, Band 5: VDI-Richtlinien 2450 Bl.1, 2453 Bl.5, 2455 Bl.1 Versuch 2: • Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren • Simulationsmethoden, speziell: Verwendung von Blockschaftbildern • Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: • Unger, HG.: Opssche Nachrichtentechnik, Teil 1: Optische Wellenleiter, Hüthing Verlag, Heidelberg, 1984 • Dakin, J., Cushaw, B.; Optical Fibre Sensors: Principles and Components. Artech House Boston, 1989 Versuch 4: • Leonhard: Einführung in die Regelungstechnik, Viewey Verlag, Braunschweig-Wiesbaden	Тур	Laboratory Course
Lecturer Dr. Wolfgang Schröder Dr. Wolfgang Schröder Language DE	Hrs/wk	2
Lecture Dr. Wolfgang Schröder Content Syperiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants automotive exhaust are used. Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated. starting will be simulated on a PC and compared with measurement. Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michel interferometer and optical fibers demonstrated. Experiment 4:identification of the parameters of a control system and optimal control parameters Literature Versuch 1: • Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftli Verlagsgesellschaft, Stuttgart, 1974 • Birkle, M.: Meßechnik für den Immissionsschutz, Messen der gas- und partikellörmigen Luftverunreinigungen. R. Oldenburg Verlag, Münch Wisen, 1979 • Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung • Gebrauchs- und Bedienungsanweisungen • VPID-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 Bi.1, 2451 Bi.4, 2453 Bi.5, 2455 Bi.1 Versuch 2: • Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren • Simulationsmethoden, speziell: Verwendung von Blockschaltbildern • Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: • Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984 • Dakin, J., Cushaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989 Versuch 4: • Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden	СР	2
Language Cycle Wise-SoSe Content Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants automotive exhaust are used. Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated. Starting will be simulated on a PC and compared with measurement. Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonems will be understood and applications with Michel interferometer and optical fibers demonstrated. Experiment 4: Adentification of the parameters of a control system and optimal control parameters Literature Versuch 1: • Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftli Verfagsgesellschaft, Shutgart, 1974 • Birkle, M.: Meßenchik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, Münch Wen, 1979 • Luthbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweitgestaltung • Gebrauchs- und Bedienungsanweisungen • VDI-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 Bi.1, 2451 Bi.4, 2453 Bi.5, 2455 Bi.1 Versuch 2: • Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren • Simulationsmethoden, speziell: Verwendung von Biockschaltbildern • Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: • Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984 • Culshaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989 Versuch 4: • Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wisebaden	Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Content WiSe/SoSe Content Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants automotive exhaust are used. Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated. starting will be simulated on a PC and compared with measurement. Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michel interferometer and optical fibers demonstrated. Experiment 4:Identification of the parameters of a control system and optimal control parameters Literature Versuch 1: Literature Litera	Lecturer	Dr. Wolfgang Schröder
Content Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants automotive exhaust are used. Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated: starting will be simulated on a PC and compared with measurement. Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michel interferometer and optical fibers demonstrated. Experiment 4:Identification of the parameters of a control system and optimal control parameters Literature Versuch 1: Literature Li	Language	DE
automotive exhaust are used. Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated starting will be simulated on a PC and compared with measurement. Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michel interferometer and optical fibers demonstrated. Experiment 4:Identification of the parameters of a control system and optimal control parameters Literature Versuch 1: • Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftli Verlagsgeseilschaft, Stuttgart, 1974 • Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, Münch Wien, 1979 • Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung • Gebrauchs- und Bedienungsanweisungen • VDI-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 Bl.1, 2451 Bl.4, 2453 Bl.5, 2455 Bl.1 Versuch 2: • Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren • Simulationsmethoden, speziell: Verwendung von Blockschaltbilderm • Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: • Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter, Hüthing Verlag, Heidelberg, 1984 • Dakin, J., Cushaw, B.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989 Versuch 4: • Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden	Cycle	WiSe/SoSe
starting will be simulated on a PC and compared with measurement. Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michel interferometer and optical fibers demonstrated. Experiment 4:identification of the parameters of a control system and optimal control parameters Literature Versuch 1: • Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftli Verlagsgesellschaft, Stuttgart, 1974 • Birkie, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, Münch Wien, 1979 • Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung • Gebrauchs- und Bedienungsanweisungen • VDI-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 Bl.1, 2451 Bl.4, 2453 Bl.5, 2455 Bl.1 Versuch 2: • Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren • Simulationsmethoden, speziell: Verwendung von Blockschaltbildern • Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: • Unger, HG.: Opische Nachrichtentechnik, Teil 1: Optische Wellenleiter, Hüthing Verlag, Heidelberg, 1984 • Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1989 Versuch 4: • Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden	Content	Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants in automotive exhaust are used.
Interferometer and optical fibers demonstrated. Experiment 4:Identification of the parameters of a control system and optimal control parameters Literature Versuch 1: Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftliv Verlagsgesellschaft, Stuttgart, 1974 Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, Münch Wien, 1979 Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung Gebrauchs- und Bedienungsanweisungen VDI-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 Bl.1, 2451 Bl.4, 2453 Bl.5, 2455 Bl.1 Versuch 2: Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren Simulationsmethoden, speziell: Verwendung von Blockschaltbildern Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984 Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1988 Culshaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989 Versuch 4: Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden		Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated. The starting will be simulated on a PC and compared with measurement.
Literature Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftliverlagsgesellschaft, Stuttgart, 1974 Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, Münch Wien, 1979 Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung Gebrauchs- und Bedlenungsanweisungen VDI-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 Bi.1, 2451 Bi.4, 2453 Bi.5, 2455 Bi.1 Versuch 2: Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren Simulationsmethoden, speziell: Verwendung von Blockschaltbildern Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984 Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1988 Culshaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989 Versuch 4: Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden		Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michelson interferometer and optical fibers demonstrated.
 Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftli Verlagsgesellschaft, Stuttgart, 1974 Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, Münch Wien, 1979 Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung Gebrauchs- und Bedienungsanweisungen VDI-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 Bl.1, 2451 Bl.4, 2453 Bl.5, 2455 Bl.1 Versuch 2: Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren Simulationsmethoden, speziell: Verwendung von Blockschaltbildern Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984 Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1988 Culshaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989 Versuch 4: Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden 		Experiment 4:Identification of the parameters of a control system and optimal control parameters
 Verlagsgesellschaft, Stuttgart, 1974 Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, Münch Wien, 1979 Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung Gebrauchs- und Bedienungsanweisungen VDI-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 Bl.1, 2451 Bl.4, 2453 Bl.5, 2455 Bl.1 Versuch 2: Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren Simulationsmethoden, speziell: Verwendung von Blockschaltbildern Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984 Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1988 Culshaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989 Versuch 4: Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden 	Literature	Versuch 1:
 Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren Simulationsmethoden, speziell: Verwendung von Blockschaltbildern Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984 Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1988 Culshaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989 Versuch 4: Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden 		 Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, München-Wien, 1979 Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung Gebrauchs- und Bedienungsanweisungen
 Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984 Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1988 Culshaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989 Versuch 4: Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden 		 Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren Simulationsmethoden, speziell: Verwendung von Blockschaltbildern
 Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1988 Culshaw, B., Dakin, J.: Optical Fibre Sensors: Systems and Application. Artech House Boston, 1989 Versuch 4: Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden 		Versuch 3:
Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden		Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1988
		Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden



	lology for Mechanical and Process Engineers	
Typ Hrs/wk	Lecture 2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Dr. Sven Krause	
Language	DE	
Cycle		
Content	1 Fundamentals	
	1.1 Quantities and Units	
	1.2 Uncertainty	
	1.3 Calibration	
	1.4 Static and Dynamic Properties of Sensors and Systems	
	2 Measurement of Electrical Quantities	
	2.1 Current and Voltage	
	2.2 Impedance	
	2.3 Amplification	
	2.4 Oscilloscope	
	2.5 Analog-to-Digital Conversion	
	2.6 Data Transmission	
	3 Measurement of Nonelectric Quantities	
	3.1 Temperature	
	3.2 Length, Displacement, Angle	
	3.3 Strain, Force, Pressure	
	3.4 Flow	
	3.5 Time, Frequency	
	4 Chemical Analysis	
	4.1 Gas Sensors	
	4.2 Spectroscopy	
	4.3 Gas Chromatography	
	At the end of each lecture students present single measuring techniques and results orally in front of the class.	
Literature	Lerch, R.: "Elektrische Messtechnik; Analoge, digitale und computergestützte Verfahren", Springer, 2006, ISBN: 978-3-540-34055-3.	
	Profos, P. Pfeifer, T.: "Handbuch der industriellen Messtechnik", Oldenbourg, 2002, ISBN: 978-3486217940.	

Course L1118: Measurement Technology for Mechanical and Process Engineers		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Sven Krause	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Courses				
itle atroduction to Control Systems (L0654)		Typ Lecture	Hrs/wk 2	CP 4
stroduction to Control Systems (L0654)		Recitation Section (small)	2	2
Module Responsible	Prof. Herbert Werner	,		
Admission Requirements	none			
Recommended Previous	Representation of signals and systems in time and f	requency domain, Laplace transform		
Knowledge				
-				
Educational Objectives	After taking part successfully, students have reached	d the following learning results		
Professional Competence	,	0 0		
Knowledge				
		avior in time and frequency domain, and can in particul	ar explain properties	of first and second ord
	systems			
		ntrol loops and interpret dynamic properties in terms of f	requency response a	nd root locus
	They can explain the Nyquist stability criterio			
	They can explain the role of the phase marg They can explain the ways a RID centrally of	, ,		
		fects a control loop in terms of its frequency response illers designed in continuous time domain are implemen	ated digitally	
	They can explain issues ansing when control	mers designed in continuous time domain are impiemer	ned digitally	
Skills				
	They can simulate and assess the behavior	amic systems from time to frequency domain and vice v	ersa	
	They can design PID controllers with the hell			
	· · · ·	ntrol loops with the help of root locus and frequency res	nonse techniques	
		ions of controllers designed in continuous-time and use		ntation
		b Control Toolbox, Simulink) for carrying out these tasks		
	,	· · · · · · · · · · · · · · · · ·		
Personal Competence				
Social Competence	Students can work in small groups to jointly solve te	chnical problems, and experimentally validate their con	troller designs	
Autonomy	Students can obtain information from provided so	urces (lecture notes, software documentation, experin	ment guides) and us	e it when solving giv
	problems.			
	They can assess their knowledge in weekly on-line	tests and thereby control their learning progress.		
	,,			
Workload in Hours	Independent Study Time 124, Study Time in Lecture	56		
Credit points				
Examination				
Examination duration and scale	120 min			
A colour of the colour	General Engineering Science (German program): C			
Assignment for the Following		ore qualification: Compulsory		
Assignment for the Following Curricula	General Engineering Science (German program, 7	ore qualification: Compulsory seemester): Specialisation Computer Science: Compulso	ory	
-			•	
	General Engineering Science (German program, 7 s General Engineering Science (German program, 7 s	semester): Specialisation Computer Science: Compulso semester): Specialisation Bioprocess Engineering: Con semester): Specialisation Naval Architecture: Compulso	npulsory	
-	General Engineering Science (German program, 7 s General Engineering Science (German program, 7 s General Engineering Science (German program, 7 s	semester): Specialisation Computer Science: Compulso semester): Specialisation Bioprocess Engineering: Com semester): Specialisation Naval Architecture: Compulso semester): Specialisation Civil Engineering: Compulsor	ipulsory iry y	
	General Engineering Science (German program, 7 : General Engineering Science (German program, 7 : General Engineering Science (German program, 7 : General Engineering Science (German program, 7 :	semester): Specialisation Computer Science: Compulso semester): Specialisation Bioprocess Engineering: Com semester): Specialisation Naval Architecture: Compulso semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Comp	opulsory ory y ulsory	
-	General Engineering Science (German program, 7 : General Engineering Science (German program, 7 :	semester): Specialisation Computer Science: Compulso semester): Specialisation Bioprocess Engineering: Compulso semester): Specialisation Naval Architecture: Compulso semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compusemester): Specialisation Electrical Engineering: Compusemester): Specialisation Biomedical Engineering: Compusement Programmes Pr	pulsory y y ulsory pulsory	
-	General Engineering Science (German program, 7 : General Engineering Science (German program) Science (German program) Science (German program) Science (German program) Science (German	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compusementer): Specialisation Electrical Engineering: Compusementer): Specialisation Biomedical Engineering: Compusementer): Specialisation Energy and Environmental Engineering: Specialisation Energy and Environmental Engineering: Compusementer): Specialisation Energy and Environmental Engineering: Compusementery: Specialisation Energy and Environmental Engineering: Compusementery: Specialisation Energy and Environmental Engineering: Compusementery: Compu	ipulsory ry y ulsory ipulsory gineering: Compulsory	y
-	General Engineering Science (German program, 7 : General Engineering Science (German program) Science (German program) Science (German program) Science (German program) Science (German	semester): Specialisation Computer Science: Compulso semester): Specialisation Bioprocess Engineering: Compulso semester): Specialisation Naval Architecture: Compulso semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compusersemester): Specialisation Electrical Engineering: Compusermester): Specialisation Biomedical Engineering: Compusermester): Specialisation Energy and Environmental Engineering: Specialisation Process Engineering: Compusermester): Specialisation Process Engineering: Compusermester Process Engin	ipulsory ry y ulsory ipulsory gineering: Compulsory lsory	
	General Engineering Science (German program, 7: General Engineering Science (German program) General Engineering General Engineering General Engineering General Engineering G	semester): Specialisation Computer Science: Compulso semester): Specialisation Bioprocess Engineering: Compuser semester): Specialisation Naval Architecture: Compulso semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compusersemester): Specialisation Biomedical Engineering: Compusemester): Specialisation Biomedical Engineering: Compusemester): Specialisation Energy and Environmental Engineering: Compusemester): Specialisation Process Engineering: Compusemester): Specialisation Mechanical Engineering, Foc	pulsory y ulsory pulsory ineering: Compulsory lsory us Mechatronics: Con	npulsory
	General Engineering Science (German program, 7: General Engineering Science (German program) General Engineering Science (German program) General Engineering General Engineer	semester): Specialisation Computer Science: Compulsor Semester): Specialisation Bioprocess Engineering: Compulsor Semester): Specialisation Naval Architecture: Compulsor Semester): Specialisation Civil Engineering: Compulsor Semester): Specialisation Electrical Engineering: Compusemester): Specialisation Biomedical Engineering: Compusemester): Specialisation Biomedical Engineering: Compusemester): Specialisation Energy and Environmental Engineering: Compusemester): Specialisation Process Engineering: Compusemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering, Foc	ipulsory y ulsory ipulsory ipulsory gineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Co	npulsory mpulsory
	General Engineering Science (German program, 7:	semester): Specialisation Computer Science: Compulsor Semester): Specialisation Bioprocess Engineering: Compulsor Semester): Specialisation Naval Architecture: Compulsor Semester): Specialisation Civil Engineering: Compulsor Semester): Specialisation Electrical Engineering: Compusemester): Specialisation Biomedical Engineering: Compusemester): Specialisation Energy and Environmental Engineering: Compusemester): Specialisation Process Engineering: Compusemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering	pulsory y ulsory pulsory pulsory gineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Coi us Aircraft Systems Ei	npulsory mpulsory ngineering: Compulso
	General Engineering Science (German program, 7:	semester): Specialisation Computer Science: Compulsor Semester): Specialisation Bioprocess Engineering: Compulsor Semester): Specialisation Naval Architecture: Compulsor Semester): Specialisation Civil Engineering: Compulsor Semester): Specialisation Electrical Engineering: Compusemester): Specialisation Biomedical Engineering: Compusemester): Specialisation Biomedical Engineering: Compusemester): Specialisation Energy and Environmental Engineering: Compusemester): Specialisation Process Engineering: Compusemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering, Foc	pulsory y ulsory pulsory pulsory gineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Coi us Aircraft Systems Ei	npulsory mpulsory ngineering: Compulso
-	General Engineering Science (German program, 7: General Engineering Science (German program, Compulsory	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compusemester): Specialisation Biomedical Engineering: Compusemester): Specialisation Energy and Environmental Engineering: Compusemester): Specialisation Process Engineering: Compusemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering	pulsory y ulsory pulsory pulsory gineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Coi us Aircraft Systems En	npulsory mpulsory ngineering: Compulso Engineering Science
-	General Engineering Science (German program, 7: General Engineering Science (German program, Compulsory General Engineering Science (German program,	semester): Specialisation Computer Science: Compulsor Semester): Specialisation Bioprocess Engineering: Compulsor Semester): Specialisation Naval Architecture: Compulsor Semester): Specialisation Civil Engineering: Compulsor Semester): Specialisation Electrical Engineering: Compusemester): Specialisation Biomedical Engineering: Compusemester): Specialisation Energy and Environmental Engineering: Compusemester): Specialisation Process Engineering: Compusemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering	pulsory y ulsory pulsory pulsory gineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Coi us Aircraft Systems En	npulsory mpulsory ngineering: Compulso Engineering Science
-	General Engineering Science (German program, 7: General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineering: Compuser Semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering, Foc 7 semester): Specialisation Mechanical Engineering, 7 semester): Specialisation Mechanical Engineering 7 semester)	pulsory y ulsory pulsory pulsory gineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Co us Aircraft Systems Ei , Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Science Mechanical Engineerin
-	General Engineering Science (German program, 7: General Engineering Science (German program, Compulsory	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compusemester): Specialisation Biomedical Engineering: Compusemester): Specialisation Energy and Environmental Engineering: Compusemester): Specialisation Process Engineering: Compusemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering, Focsemester): Specialisation Mechanical Engineering	pulsory y ulsory pulsory pulsory gineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Co us Aircraft Systems Ei , Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Science Mechanical Engineerin
-	General Engineering Science (German program, 7: Compulsory	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineerity: Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering for semester): Specialisation Mechanical Engineering, I semester): Specialisation Mechanical Engineering Specialisation Mechanical Engineering Specialisation Mechanical Engineering Specialisation Mechanical Engineering Specialisation Mechani	pulsory y ulsory pulsory pulsory pineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems En , Focus Materials in Focus Theoretical M	npulsory mpulsory ngineering: Compulso Engineering Science Mechanical Engineering opment and Production
	General Engineering Science (German program, 7: General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7:	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineering: Compuser semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering, 7 semester): Specialisation Mechanical Engineering, 7 semester): Specialisation Mechanical Engineering, 8 semester):	pulsory y ulsory pulsory pulsory pineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems En , Focus Materials in Focus Theoretical M	npulsory mpulsory ngineering: Compulso Engineering Science Mechanical Engineering opment and Production
-	General Engineering Science (German program, 7: General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7: Bioprocess Engineering: Core qualification: Compulsions of the service of the servic	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineering: Compuser semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering, 7 semester): Specialisation Mechanical Engineering, 7 semester): Specialisation Mechanical Engineering, 8 semester): Specialisation Mechanical Engineering, 9 semester):	pulsory y ulsory pulsory pulsory pineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems En , Focus Materials in Focus Theoretical M	npulsory mpulsory ngineering: Compulso Engineering Science Mechanical Engineering opment and Production
-	General Engineering Science (German program, 7: General Engineering Science (German program, Compulsory General Engineering Science (German program, Compulsory General Engineering Science (German program, 7: Bioprocess Engineering: Core qualification: Comput Computer Science: Specialisation Computational Metals (German Metals)	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineering: Compuser semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering, 7 semester): Specialisation Mechanical Engineering, 8 semester): Specialisation Mechanical Engineering, 9 semester	pulsory y ulsory pulsory pulsory pineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems En , Focus Materials in Focus Theoretical M	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri opment and Production
	General Engineering Science (German program, 7: General Engineering Science (German program, Compulsory General Engineering Science (German program, 7: General Engineering Science (German program, 7: Bioprocess Engineering: Core qualification: Comput Computer Science: Specialisation Computational M Electrical Engineering: Core qualification: Computs	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineering: Compuser semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering, Foc 3 semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering Specialisation Mechanical Engineering Specialisation Mechanical E	pulsory y ulsory pulsory pulsory pineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems En , Focus Materials in Focus Theoretical M	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri opment and Producti
-	General Engineering Science (German program, 7: Bioprocess Engineering: Core qualification: Comput Computer Science: Specialisation Computational M Electrical Engineering: Core qualification: Computs Energy and Environmental Engineering: Core qualification: Computs	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineering: Compuser semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering Specialisation Mechanical Engineering Specialisation Mechanical Eng	pulsory y ulsory pulsory pulsory pineering: Compulsory lsory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems En , Focus Materials in Focus Theoretical M	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri opment and Producti
-	General Engineering Science (German program, 7: Compulsory General Engineering Science (German program, 7: Bioprocess Engineering Science (German program, 7: Bioprocess Engineering: Core qualification: Comput Computer Science: Specialisation Computational M Electrical Engineering: Core qualification: Computs Energy and Environmental Engineering: Core qualification: Core qualification: Core qualification: Computs	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering	pulsory y ulsory pulsory pulsory pulsory gineering: Compulsory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems En Focus Theoretical M Focus Product Develous Energy Systems: C	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri opment and Producti
-	General Engineering Science (German program, 7: Compulsory General Engineering Science (German program, 7: General Engineering: Core qualification: Comput Computer Science: Specialisation Computational M Electrical Engineering: Core qualification: Computs Energy and Environmental Engineering: Core qualification: Core qualification: Computational M Electrical Engineering Science (English program): Core General Engineering Science (English program, 7: Seneral Engineering Science (English program): Core General Engineering Science (English program, 7: Seneral Engineering Science (English program): Core General Engineering Science (English program): Core Qualification: Computational M Engineering Science (English program): Core Qualification: Core Qualification: Core Qualification: Core Qualification: Core Qualific	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineering: Compuser semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering	ipulsory y y ulsory ipulsory ipulsory gineering: Compulsory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems En Focus Theoretical M Focus Theoretical M Focus Product Develous Energy Systems: C	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri opment and Producti
-	General Engineering Science (German program, 7: Compulsory General Engineering Science (German program, 7: General Engineering Science (German program, 7: Bioprocess Engineering: Core qualification: Comput Computer Science: Specialisation Computational M Electrical Engineering: Core qualification: Computs Energy and Environmental Engineering: Core qualification: Core qualification: Computs General Engineering Science (English program): Computational Engineering Science (English program, 7: General Engineering Science (English program,	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineering: Compuser semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Foc semester): Specialisation Mechanical Engineering Computer Science: Compulsory semester): Specialisation Bioprocess Engineering: Computer Science: Compulsory semester): Specialisation Bioprocess Engineering: Computer Science: Computer Science: Computer Science: Computer Science:	ipulsory ipulsory y ulsory ipulsory ipulsory ipulsory isory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems En Focus Theoretical M Focus Theoretical M Focus Product Devel us Energy Systems: C	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri opment and Producti
-	General Engineering Science (German program, 7: Compulsory General Engineering Science (German program, 7: General Engineering Science (German program, 7: General Engineering Science (German program, 7: Bioprocess Engineering: Core qualification: Comput Computer Science: Specialisation Computational M Electrical Engineering: Core qualification: Compute Energy and Environmental Engineering: Core qualification: Compute General Engineering Science (English program, 7: General Engineering	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineering: Compuser semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Focus semester): Specialisation Compulsory semester): Specialisation Compulsory semester): Specialisation Computer Science: Compulsory semester): Specialisation Bioprocess Engineering: Compulsory semester): Specialisation Naval Architecture: Compulsory semester): Specialisation Nav	ipulsory ipulsory y ulsory ipulsory ipulsory ipulsory isory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems Er , Focus Materials in Focus Theoretical M Focus Product Devel us Energy Systems: C	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri opment and Producti
-	General Engineering Science (German program, 7: Compulsory General Engineering Science (German program, 7: Bioprocess Engineering Science (German program, 7: Bioprocess Engineering: Core qualification: Comput Computer Science: Specialisation Computational M Electrical Engineering: Core qualification: Comput General Engineering Science (English program): C General Engineering Science (English program, 7:	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineering: Compuser semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Focus semester): Specialisation Compulsory semester): Specialisation Computer Science: Compulsory semester): Specialisation Computer Science: Compulsory semester): Specialisation Raval Architecture: Compulsory semester): Specialisation Raval Architecture: Compulsory semester): Specialisation Civil Engineering: Compulsory semester): Specialisation	ipulsory ipulsory y ulsory ipulsory ipulsory ipulsory isory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems Er , Focus Materials in Focus Theoretical M Focus Product Devel us Energy Systems: Con ipulsory i	npulsory mpulsory ngineering: Compulso Engineering Scienc Mechanical Engineeri opment and Producti
-	General Engineering Science (German program, 7: Compulsory General Engineering Science (German program, 7: Bioprocess Engineering Science (German program, 7: Bioprocess Engineering: Core qualification: Comput Computer Science: Specialisation Computational M Electrical Engineering: Core qualification: Comput General Engineering Science (English program, 7:	semester): Specialisation Computer Science: Compulsor semester): Specialisation Bioprocess Engineering: Compulsor semester): Specialisation Naval Architecture: Compulsor semester): Specialisation Civil Engineering: Compulsor semester): Specialisation Electrical Engineering: Compuser semester): Specialisation Biomedical Engineering: Compuser semester): Specialisation Energy and Environmental Engineering: Compuser semester): Specialisation Process Engineering: Compuser semester): Specialisation Mechanical Engineering, Focus semester): Specialisation Compulsory semester): Specialisation Compulsory semester): Specialisation Computer Science: Compulsory semester): Specialisation Bioprocess Engineering: Compulsory semester): Specialisation Naval Architecture: Compulsory semester): Specialisation Nav	ipulsory ipulsory y ulsory ipulsory ipulsory ipulsory ipulsory isory us Mechatronics: Con us Biomechanics: Con us Aircraft Systems Er ipulsory	npulsory mpulsory ngineering: Compulso Engineering Science Mechanical Engineerin



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory

General Engineering, Science (English program, 7 semester): Specialisation, Mechanical Engineering, Focus Materials in Engineering, Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering, Focus\ Energy\ Systems:\ Compulsory\ Specialisation\ Mechanical\ Engineering, Focus\ Energy\ Systems:\ Compulsory\ Specialisation\ Mechanical\ Engineering,\ Focus\ Engineer$

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

e L0654: Introduction to Contr	ol Systems		
Тур	Lecture		
Hrs/wk	2		
СР	4		
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28		
Lecturer	Prof. Herbert Werner		
Language	DE		
Cycle	WiSe		
Content	Signals and systems		
	Linear systems, differential equations and transfer functions		
	First and second order systems, poles and zeros, impulse and step response		
	Stability		
	Feedback systems		
	Principle of feedback, open-loop versus closed-loop control		
	Reference tracking and disturbance rejection		
	Types of feedback, PID control		
	System type and steady-state error, error constants		
	Internal model principle		
	Root locus techniques		
	Root locus plots		
	Root locus prois Root locus design of PID controllers		
	Frequency response techniques		
	Bode diagram Minimum and non-minimum phase systems.		
	Minimum and non-minimum phase systems		
	Nyquist plot, Nyquist stability criterion, phase and gain margin		
	Loop shaping, lead lag compensation		
	Frequency response interpretation of PID control		
	Time delay systems		
	Root locus and frequency response of time delay systems		
	Smith predictor		
	Digital control		
	Sampled-data systems, difference equations		
	Tustin approximation, digital implementation of PID controllers		
	Software tools		
	Introduction to Matlab, Simulink, Control toolbox		
	Computer-based exercises throughout the course		
	,		
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"		
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009		
K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010			
R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010			



Course L0655: Introduction to Control Systems		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Herbert Werner	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1275: Environme	ntal Technology				
Courses					
Title		Тур	Hrs/wk	СР	
Practical Exercise Environmental Technol	ogy (L1387)	Laboratory Course	1	1	
Environmental Technologie (L0326)		Lecture	2	2	
Module Responsible	Dr. Joachim Gerth				
Admission Requirements	None				
Recommended Previous	Fundamentals of inorganic/organic chemistry and biology				
Knowledge					
Educational Objectives	After taking part successfully, students have reached the following l	learning results			
Professional Competence					
Knowledge	With the completion of this modul the students obtain profound k	knowledge of environmental technological	ogy. They are able to de	escribe the behaviour of	
	chemicals in the environment. Students can give an overview of	scientific disciplines involved. They	can explain terms and	allocate them to related	
	methods.				
Skille	Students are able to propose appropriate management and mitiga	ation moscures for anyironmental pro	blome Thoy are able to	dotormino goodhomical	
Skills	parameters and to assess the potential of pollutants to migrate				
	Environmental Technology contributes to sustainable development			·	
	Environmental recimiology contributes to sustainable development	t, and they can present and determ th	osc opinions in noncora	na agamet the group.	
Personal Competence					
Social Competence	The students are able to discuss the various technical and scientification	ic tasks, both subject-specific and mu	ıltidisciplinary. They are	able to develop different	
	approaches to the task as a group as well as to discuss their theore	etical or practical implementation.			
Autonomy	Students can independently exploit sources about of the subject, as	cquire the particular knowledge and t	ranfer it to new problems	S.	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42				
Credit points	3				
Examination	Written exam				
Examination duration and scale	1 hour written exam				
Assignment for the Following	General Engineering Science (German program): Specialisation Er	nergy and Enviromental Engineering	: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Pr	rocess Engineering: Elective Compul	sory		
	General Engineering Science (German program, 7 semester): Spec	cialisation Energy and Enviromental I	Engineering: Compulsor	у	
	General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Elec	tive Compulsory		
	General Engineering Science (German program, 7 semester): Spec	cialisation Bioprocess Engineering: E	lective Compulsory		
	Bioprocess Engineering: Core qualification: Elective Compulsory				
	Energy and Environmental Engineering: Core qualification: Compu	*			
	General Engineering Science (English program): Specialisation En	• •			
	General Engineering Science (English program): Specialisation Program				
	General Engineering Science (English program, 7 semester): Spec	**		/	
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Elective Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Elective Compulsory				
	Process Engineering: Core qualification: Elective Compulsory				

Course L1387: Practical Exercise Environmental Technology			
Тур	Laboratory Course		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Dr. Joachim Gerth		
Language	DE		
Cycle	SoSe		
	The experiment demonstrates the effect of ionic strength on the binding of dissolved zinc and phosphate by soil surfaces. From the results it can be inferred that the potential of soil surfaces is modified by the application of salt. This has consequences for the retention of nutrients and pollutants. The experiment is carried out with iron oxide rich soil material. Within the lab course students discuss the various technical and scientific tasks, both subject-specific and multidisciplinary. They discuss different approaches to the task as well as it's theoretical or practical implementation.		
Literature	F. Scheffer und P. Schachtschabel (2002): "Lehrbuch der Bodenkunde" TUB Signatur AGG-308 W.E.H. Blum (2007): "Bodenkunde in Stichworten" TUB Signatur AGG-317 C. A. J. Appelo; D. Postma (2005): "Geochemistry, groundwater and pollution" TUB Signatur GWC-515		



Course L0326: Environmental Tech	nologie
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Joachim Gerth, Prof. Martin Kaltschmitt, Prof. Kerstin Kuchta
Language	DE
Cycle	WiSe
Content	1. Introductory seminar on environmental science: 2. Environmental impact and adverse effects 3. Wastewater technology 4. Air pollution control 5. Noise protection 6. Waste and recycling management 7. Soil and ground water protection 8. Renewable energies 9. Resource conservation and energy efficiency
Literature	Förster, U.: Umweltschutztechnik; 2012; Springer Berlin (Verlag) 8., Aufl. 2012; 978-3-642-22972-5 (ISBN)



Modulo M0520, Dresses	d Dlont Engineering I				
Module M0539: Process an	d Plant Engineering I				
Courses					
Title		Тур	Hrs/wk	СР	
Process and Plant Engineering I (L0095)		Lecture	2	2	
Process and Plant Engineering I (L0096)		Recitation Section (large)	1	2	
Process and Plant Engineering I (L1214)		Recitation Section (small)	1	2	
Module Responsible	Prof. Georg Fieg				
Admission Requirements	none				
Recommended Previous	unit operation of thermal an dmechanical separation processes				
Knowledge	chemical reactor eingineering				
Educational Objectives	After taking part successfully, students have reached the following	learning results			
Professional Competence					
Knowledge	students can:				
	classify and formulate blobal balance equations of chemical proce	sses			
	specify linear component equations of complex chemical processes	es			
	explain linear regression and data reconcilliation problems				
	explain pfd-diagrams				
Skills	students are capable of				
	- formulation of mass and energy balance equations and estimation	n of product streams			
	- estimation of component streams of chemical plants using linear	component balance models			
	- solution of data reconcilliation tasks				
	- conduction of process synthesis				
	- economic evaluation of processes and the estimation of production	on costs			
Personal Competence					
Social Competence					
Autonomy					
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56				
Credit points	6				
Examination	Written exam				
Examination duration and scale	120 Min. lectures notes and books				
Assignment for the Following	General Engineering Science (German program): Specialisation F	Process Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisation E				
	General Engineering Science (German program, 7 semester): Spe	cialisation Process Engineering: Compu	sory		
	General Engineering Science (German program, 7 semester): Spe	cialisation Bioprocess Engineering: Com	pulsory		
	General Engineering Science (German program, 7 semester): Spe			mpulsory	
	Bioprocess Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation B	ioprocess Engineering: Compulsory			
	General Engineering Science (English program): Specialisation P				
	General Engineering Science (English program, 7 semester): Spe	cialisation Process Engineering: Compul	sory		
	General Engineering Science (English program, 7 semester): Spe	cialisation Bioprocess Engineering: Com	oulsory		
	General Engineering Science (English program, 7 semester): Spe	cialisation Energy and Enviromental Eng	neering: Elective Co	mpulsory	
	Process Engineering: Core qualification: Compulsory				

Course L0095: Process and Plant Engineering I	
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Course work	none
Lecturer	Prof. Georg Fieg
Language	DE
Cycle	SoSe
Content	1. Introduction Structure and operation of production plants Operational business process Technical process design Motivation and targets of process development Life cycle of production plants 2. Engineering methods and tools Mass and energy balances Strategies of process synthesis Graphical representation of processes Multidimensional regression



Module Manual B. Sc	. "General Engineering Science (English program, 7 semester)"	UHH Universität Hamburg-Ha
	Data reconciliation and data validation 3. Process Synthesis Decision levels Experimental process development Reactor synthesis Synthesis of separation processes (process alternatives and criteria for selection) Integration of reaction systems/separation systems (interactions, recycle streams) 4. Process safety 5. Cost estimation of production plants Production costs, capital costs, economic evaluation	
Literature		
	S.D. Barnicki, J.R. Fair, Ind. End. Chem., 29(1990), S. 421, Ind. End. Chem., 31(1992), S. 1679	
	H. Becker, S. Godorr, H. Kreis, Chemical Engineering, January 2001, S. 68-74	
	Behr, W. Ebbers, N. Wiese, ChemIngTech. 72(2000)Nr. 10, S.1157 E. Blass, Entwicklung verfahrenstechnischer Prozesse, Springer-Verlag, 2. Auflage 1997	
	M. H. Bauer, J. Stichlmair, ChemIngTech., 68(1996), Nr. 8, 911-916	
	R. Dittmeyer, W. Keim, G. Kreysa, A. Oberholz, Chemische Technik. Prozesse und Produkte,	
	Band 2, Neue Technologien, 5. Auflage, Wiley-VCH GmbH&Co.KGaA, Weinheim, 2004	
	J.M. Douglas, Conceptual Design of Chemical Processes, Mc Graw-Hill, NY, 1988	
	G. Fieg, Inz. Chem. Proc., 5(1979), S.15-19	
	G. Fieg, G. Wozny, L. Jeromin, Chem. Eng. Technol. 17(1994),5, 301-306	
	G. Fieg, Heat and Mass Transfer 32(1996), S. 205-213	
	G. Fieg, Chem. Eng. Processing, Vol. 41/2(2001), S. 123-133	
	U.H. Felcht, Chemie eine reife Industrie oder weiterhin Innovationsmotor, Universitätsbuchhandlung Blazek und Bergamann, Frankfurt, 2000	
	J.P. van Gigch, Systems Design, Modeling and Metamodeling, Plenum Press, New York, 1991	
	T.F. Edgar, D.M. Himmelblau, L.S. Lasdon, Optimization of Chemical Processes, McGraw-Hill, 2001	
	G. Gruhn, Vorlesungsmanuskript "Prozess- und Anlagentechnik, TU Hamburg-Harburg	
	D. Hairston, Chemical Engineering, October 2001, S. 31-37	
	J.L.A. Koolen, Design of Simple and Robust Process Plants, Wiley-VCH, Weinheim, 2002	
	J. Krekel, G. Siekmann, ChemIngTech. 57(1985)Nr. 6, S. 511	
	K. Machej, G. Fieg, J. Wojcik, Inz. Chem. Proc., 2(1981), S.815-824	
	S. Meier, G. Kaibel, ChemIngTech. 62(1990)Nr. 13, S.169	
	J. Mittelstraß, ChemIngTech. 66(1994), S. 309	
	P. Li, M. Flender, K. Löwe, G. Wozny, G. Fieg, Fett/Lipid 100(1998), Nr. 12, S. 528-534	
	G. Kaibel, Dissertation, TU München, 1987	
	G. Kaihel, ChemIngTech 61 (1989), Nr. 2, S. 104-112	

G. Kaibel, Chem.-Ing.-Tech. 61 (1989), Nr. 2, S. 104-112

G. Kaibel, Chem. Eng. Technol., 10(1987), Nr. 2, S. 92-98

H.J. Lang, Chem. Eng. 54(10),117, 1947

H.J. Lang, Chem. Eng. 55(6), 112, 1948

F. Lestak, C. Collins, Chemical Engineering, July 1997, S. 72-76

Course L0096: Process and Plant Engineering I	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Course work	none
Lecturer	Prof. Georg Fieg
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L1214: Process and Plant Engineering I	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Course work	none
Lecturer	Prof. Georg Fieg
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0670: Particle Ted	chnology and Solids Process Engineering			
Courses				
Title		Тур	Hrs/wk	СР
Particle Technology I (L0434)		Lecture	2	3
Particle Technology I (L0435)		Recitation Section (small)	1	1
Particle Technology I (L0440)		Laboratory Course	2	2
Module Responsible	Prof. Stefan Heinrich			
Admission Requirements	None			
Recommended Previous	keine			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence				
Knowledge	After successful completion of the module students are able to			
	 name and explain processes and unit-operations of solids pr 	ocess engineering.		
	characterize particles, particle distributions and to discuss the			
Skills	Students are able to			
	a change and decign apparatures and processes for callide pro	accoing according to the decired cell	do proportino of the pro	duat
	 choose and design apparatuses and processes for solids pro asses solids with respect to their behavior in solids processin 		as properties of the pro	duci
	document their work scientifically.	g steps		
	document their work scientifically.			
Personal Competence				
Social Competence	Social Competence The students are able to discuss scientific topics orally with other students or scientific personal and to develop solutions for technical-scientific		nnical-scientific issues in	
	a group.			
Autonomy	Students are able to analyze and solve questions regarding solid pa	rticles independently.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation Pro	cess Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Bio	process Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Eng	ergy and Enviromental Engineering: 0	Compulsory	
	General Engineering Science (German program, 7 semester): Specia	alisation Process Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester): Specia			
	General Engineering Science (German program, 7 semester): Specia	alisation Energy and Enviromental Er	ngineering: Compulsor	у
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compuls	*		
	General Engineering Science (English program): Specialisation Biop			
	General Engineering Science (English program): Specialisation Ene		ompulsory	
	General Engineering Science (English program): Specialisation Prod			
	General Engineering Science (English program, 7 semester): Specia		•	
	General Engineering Science (English program, 7 semester): Specia			
	General Engineering Science (English program, 7 semester): Specia	lisation Energy and Enviromental En	gineering: Compulsory	1
	Process Engineering: Core qualification: Compulsory			



Course L0434: Particle Technology I		
Тур	Lecture	
Hrs/wk		
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Stefan Heinrich	
Language	DE	
Cycle	SoSe	
Content Description of particles and particle distributions Description of a separation process Description of a particle mixture Particle size reduction Agglomeration, particle size enlargement Storage and flow of bulk solids Basics of fluid/particle flows classifying processes Separation of particles from fluids Basic fluid mechanics of fluidized beds Pneumatic and hydraulic transport		
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.	

Course L0435: Particle Technology I	
Тур	Recitation Section (small)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0440: Particle Technology	I		
Тур	boratory Course		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Stefan Heinrich		
Language	DE		
Cycle	SoSe		
Content	 Sieving Bulk properties Size reduction Mixing Gas cyclone Blaine-test, filtration Sedimentation 		
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.		



lodule M0829: Foundation	ns of Management			
ourses				
tle		Тур	Hrs/wk	СР
troduction to Management (L0880)		Lecture	3	3
oject Entrepreneurship (L0882)		Problem-based Learning	2	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learnin	g results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of many diff Marketing and Innovation, and also to Investment and Controlling. In parti		anagement, from Plani	ning and Organisation
	explain the differences between Economics and Management and field of Management	the sub-disciplines in Manager	nent and to name impo	ortant definitions from
	explain the most important aspects of and goals in Management as	nd name the most important asp	ects of entreprneurial	orojects
	describe and explain basic business functions as production, pro	curement and sourcing, supply	chain management,	organization and hun
	ressource management, information management, innovation mar	agement and marketing		
	explain the relevance of planning and decision making in Busin	ess, esp. in situations under m	ultiple objectives and	uncertainty, and expl
	some basic methods from mathematical Finance			
	state basics from accounting and costing and selected controlling	nethods.		
Skills	Students are able to analyse business units with respect to different Entrepreneurship project in a team. In particular, they are able to	ent criteria (organization, obje	ctives, strategies etc	.) and to carry out
	analyse Management goals and structure them appropriately			
	analyse organisational and staff structures of companies	and the state of t		
	apply methods for decision making under multiple objectives, under			
	 analyse production and procurement systems and Business inform analyse and apply basic methods of marketing 	ation systems		
	select and apply basic methods from mathematical finance to pred	efined problems		
	apply basic methods from accounting, costing and controlling to predict a specific product of the second seco			
	apply sade methods from accounting, cooling and controlling to pr	sacimoa prosicino		
Personal Competence				
Social Competence	Students are able to			
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepreneurship p	oiect and write a coherent reno	rt on the project	
	to communicate appropriately and	ojost and mile a concretit oper		
	to cooperate respectfully with their fellow students.			
Autonomy	Students are able to			
	work in a team and to organize the team themselves			
	to write a report on their project.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points				
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation Electrica	Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Computer	r Science: Compulsory		
	General Engineering Science (German program): Specialisation Process	Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Bioproce	ss Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Energy a			
	General Engineering Science (German program): Specialisation Civil- and		ompulsory	
	General Engineering Science (German program): Specialisation Mechani			
	General Engineering Science (German program): Specialisation Biomedi			
	General Engineering Science (German program): Specialisation Naval Ar			
	General Engineering Science (German program, 7 semester): Specialisat			
	General Engineering Science (German program, 7 semester): Specialisat			
	General Engineering Science (German program, 7 semester): Specialisat			
	General Engineering Science (German program, 7 semester): Specialisat	·	•	
	General Engineering Science (German program, 7 semester): Specialisat	·	•	
	General Engineering Science (German program, 7 semester): Specialisat			
	General Engineering Science (German program, 7 semester): Specialisat		•	.,
	General Engineering Science (German program, 7 semester): Specialisat			
	General Engineering Science (German program, 7 semester): Specialisat	-		
	General Engineering Science (German program, 7 semester): Specialisat	-		
	General Engineering Science (German program, 7 semester): Specialisat	-	•	
	General Engineering Science (German program, 7 semester): Specia	isalion Mechanical Engineerin	g, Focus Materials ir	ı ⊑ngineering Sciend
	Compulsory	notion Monkeyies! Factors !	Footo Theory	Apphanical Facility
	General Engineering Science (German program, 7 semester): Speciali	sauori wechanicai Engineering	, rocus ineoretical l	viecnanicai Engineeri
	i e			



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

ompulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

 $\label{thm:control_general} \textbf{General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory and Compulso$

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program); Specialisation Energy and Environmental Engineering; Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program); Specialisation Process Engineering; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester); Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences
Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 $\label{thm:mechanical engineering:Core qualification:Compulsory} Mechanical Engineering: Core qualification: Compulsory$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



urse L0880: Introduction to Management Typ Lecture		
	3	
Hrs/wk		
	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga	
Lammina	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona DE	
Language	WiSe/SoSe	
Cycle	WI26/2026	
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects 	
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008	
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003	
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.	
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.	
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.	
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.	
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.	

Course L0882: Project Entrepreneurship		
Тур	Problem-based Learning	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Lecturer Prof. Christoph IhI, Ann-Isabell Hnida, Hamed Farhadian, Katharina Roedelius, Oliver Welling, Maximilian Muelke	
Language DE		
Cycle WiSe/SoSe		
Content In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the		
using their knowledge from the corresponding lecture.		
	Project work is carried out in teams with the support of a mentor.	
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.	



Module M0891: Informatics	for Process Engineers			
Courses				
Courses		T	Han fada	0.0
Title		Тур	Hrs/wk 2	CP
Informatics for Process Engineers (L0836 Informatics for Process Engineers (L0837		Lecture Recitation Section (small)	2	2
Numeric and Matlab (L0125))	Laboratory Course	2	2
Module Responsible	Dr Marcus Venzke	Eaboratory Course		
Admission Requirements	None.			
Recommended Previous	Basic knowledge in using MS Windows.			
Knowledge	Date the medge in doing the times no.			
Educational Objectives	After taking part successfully, students have reached the following learning	a results		
Professional Competence	J	<u> </u>		
•	Students can describe procedural and object-oriented concepts.			
Skills	Students are capable of object-oriented programming in the programing I Students are capable of developing concepts (simple algorithms) to solve		natic questions by	vusing Matlab.
	Students are able to work out solutions together in small groups.			
Autonomy	-			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Process			
Curricula	General Engineering Science (German program, 7 semester): Specialisa			ompulsory
	General Engineering Science (German program, 7 semester): Specialisa	ion Process Engineering: Elective Co	ompulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Process	Engineering: Elective Compulsory		
	General Engineering Science (English program, 7 semester): Specialisati	on Energy and Enviromental Engine	ering: Elective Co	ompulsory
	General Engineering Science (English program, 7 semester): Specialisati	on Process Engineering: Elective Co	mpulsory	
	Process Engineering: Core qualification: Compulsory			



Course L0836: Informatics for Process Engineers		
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Marcus Venzke	
Language	DE	
Cycle	SoSe	
Content	Introduction to object-oriented modelling and programming exemplified with Java	
	Objects, classes Methods, properties Inheritance Basics of the language Java Sample application: Simulation of an electricity network 2D graphics Events and Controls	
Literature	Campione, Mary; Walrath, Kathy: The Java Tutorial - A practical guide for programmers. Addison-Wesley, Reading, Massachusets, 1998. Bibliothek: TII 978 Krüger, Guido; Hansen, Heiko: Handbuch der Java-Programmierung. 3. Auflage Addison-Wesley, 2002. http://www.javabuch.de/ Krüger, Guido: Go to Java 2. Addison-Wesley Verlag, Bonn, 1999. Bibliothek: TII 717 Cowell, John: Essential Java 2 fast. Springer Verlag, London, 1999. Bibliothek: TII 942 Java SE 7 Documentation http://docs.oracle.com/javase/7/docs/ Java Platform, Standard Edition 7 API Specification http://docs.oracle.com/javase/7/docs/api/	

Course L0837: Informatics for Process Engineers			
Тур	Recitation Section (small)		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Dr. Marcus Venzke		
Language	DE		
Cycle	SoSe		
Content	In the lab, the content from the lecture is practiced and deepened with practical assignments. Every week one or two programming tasks are assigned.		
	These are solved by the students on computers independently, coached by a tutor.		
Literature	Campione, Mary; Walrath, Kathy: The Java Tutorial - A practical guide for programmers. Addison-Wesley, Reading, Massachusets, 1998.		
	Bibliothek: TII 978		
	Krüger, Guido; Hansen, Heiko: Handbuch der Java-Programmierung. 3. Auflage Addison-Wesley, 2002.		
	http://www.javabuch.de/		
	Krüger, Guido: Go to Java 2. Addison-Wesley Verlag, Bonn, 1999.		
	Bibliothek: TII 717		
	Cowell, John: Essential Java 2 fast. Springer Verlag, London, 1999.		
	Bibliothek: TII 942		
	Java SE 7 Documentation		
	http://docs.oracle.com/javase/7/docs/		
	Java Platform, Standard Edition 7 API Specification		
	http://docs.oracle.com/javase/7/docs/api/		



Course L0125: Numeric and Matlab		
Тур	Laboratory Course	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Siegfried Rump, Weitere Mitarbeiter	
Language	DE	
Cycle	SoSe	
Content	1. Programming in Matlab 2. Numerical methods for systems of nonlinear equations 3. Basics in computer arithmetic 4. Linear and nonlinear optimization 5. Condition of problems and algorithms 6. Verified numerical results with INTLAB	
Literature	Literatur (Software-Teil): 1. Moler, C., Numerical Computing with MATLAB, SIAM, 2004 2. The Math Works, Inc., MATLAB: The Language of Technical Computing, 2007 3. Rump, S. M., INTLAB: Interval Labority, http://www.ti3.tu-harburg.de 4. Highham, D. J.; Highham, N. J., MATLAB Guide, SIAM, 2005	



Module M1274: Environme	ntal Technology			
Courses				
Title		Тур	Hrs/wk	СР
Environmental Assessment (L0860)		Lecture	2	2
Environmental Assessment (L1054)		Recitation Section (small)	1	1
Module Responsible	Prof. Martin Kaltschmitt			
Admission Requirements	None			
Recommended Previous	Fundamentals of inorganic/organic chemistry and biology			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the foll	owing learning results		
Professional Competence				
Knowledge	With the completion of this module the students acquire in-depth knowledge of important cause-effect chains of potential environmental problems which			
	might occur from production processes, projects or construc	tion measures. They have knowledge abou	t the methodological div	ersity and are competer
	in dealing with different methods and instruments to asses	s environmental impacts. Besides the stude	ents are able to estimate	the complexity of thes
	environmental processes as well as uncertainties and difficu	ulties with their measurement.		
Skills	The students are able to select a suitable method for the re	espective case from the variety of assessme	ent methods. Thereby th	ney can develop suitab
	solutions for managing and mitigating environmental pro-	blems in a business context. They are ab	le to carry out Life Cy	cle Impact Assessmen
	independently and can apply the software programs OpenL		ng the course the stude	nts have the competend
	to critically judge research results or other publications on e	nvironmental impacts.		
Personal Competence				
Social Competence	The students are able to discuss the various technical and	scientific tasks, both subject-specific and n	nultidisciplinary. They a	re able to develop join
coola. competence	different solutions and to discuss their theoretical or practic			
	multi-layered issues of the environment protection and the	·	•	-
	raised and which helps to raise their awareness of their futu			
		3		
Autonomy	The students learn to research, process and present a science	entific topic independently. They are able to	carry out independent	scientific work. They ca
	solve an environmental problem in a business context and a			
		, , , ,		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Examination	Written exam			
Examination duration and scale	1 hour written exam			
Assignment for the Following	General Engineering Science (German program): Specialisa	ation Energy and Enviromental Engineering	: Compulsory	
Curricula	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program, 7 semeste	r): Specialisation Energy and Enviromental I	Engineering: Compulsor	у
	General Engineering Science (German program, 7 semeste	r): Specialisation Process Engineering: Elec	tive Compulsory	
	General Engineering Science (German program, 7 semeste	r): Specialisation Bioprocess Engineering: E	lective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compu	ılsory		
	Energy and Environmental Engineering: Core qualification:	Compulsory		
	General Engineering Science (English program): Specialisa	ation Energy and Enviromental Engineering:	Compulsory	
	General Engineering Science (English program): Specialisa	ation Process Engineering: Elective Compuls	sory	
	General Engineering Science (English program, 7 semester	r): Specialisation Energy and Enviromental E	ngineering: Compulsor	/
	General Engineering Science (English program, 7 semester	r): Specialisation Process Engineering: Elect	ive Compulsory	
	General Engineering Science (English program, 7 semester	r): Specialisation Bioprocess Engineering: E	ective Compulsory	
	Process Engineering: Core qualification: Elective Compulso	ry		
	Process Engineering: Core qualification: Compulsory			



Course L0860: Environmental Assessment		
Тур	Lecture	
Hrs/wk	k 2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Anne Rödl, Dr. Christoph Hagen Balzer	
Language	DE/EN	
Cycle	SoSe	
Content	Contaminants: Impact- and Risk Assessment	
	Environmental damage & precautionary principle: Environmental Risk Assessment (ERA)	
	Resource and water consumption: Material flow analysis	
	Energy consumption: Cumulated energy demand (CED), cost analysis	
	Life cycle concept: Life cycle assessment (LCA)	
	Sustainability: Comprehensive product system assessment , SEE-Balance	
	Management: Environmental and Sustainability management (EMAS)	
	Complex systems: MCDA and scenario method	
Literature	Foliensätze der Vorlesung	
	Studie: Instrumente zur Nachhaltigkeitsbewertung - Eine Synopse (Forschungszentrum Jülich GmbH)	

Course L1054: Environmental Assessment			
Тур	Recitation Section (small)		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Prof. Martin Kaltschmitt		
Language	DE		
Cycle	SoSe		
Content	Presentation and application of free software programs in order to understand the concepts of environmental assessment methods better.		
	Within the group exercise students discuss the various technical and scientific tasks, both subject-specific and multidisciplinary. They discuss different approaches to the task as well as it's theoretical or practical implementation.		
Literature	Power point Präsentationen		



Thesis

Module M-001: Bachelor Th	nesis
Courses	
	Tun Heatel OR
Title	Typ Hrs/wk CP
Module Responsible	Professoren der TUHH
Admission Requirements	According to General Regulations §24 (1):
	At least 400 FOTO and it asiate house to be achieved in a today are some The average at a second decider a second in
	At least 126 ECTS credit points have to be achieved in study programme. The examinations board decides on exceptions.
Recommended Previous	
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The students can select, outline and, if need be, critically discuss the most important scientific fundamentals of their course of study (facts,
	theories, and methods).
	On the basis of their fundamental knowledge of their subject the students are capable in relation to a specific issue of opening up and
	establishing links with extended specialized expertise.
	The students are able to outline the state of research on a selected issue in their subject area.
Skills	
Okliis	The students can make targeted use of the basic knowledge of their subject that they have acquired in their studies to solve subject-related
	problems.
	With the aid of the methods they have learnt during their studies the students can analyze problems, make decisions on technical issues, and
	develop solutions.
	The students can take up a critical position on the findings of their own research work from a specialized perspective.
Personal Competence	
Social Competence	
oodal oompetence	Both in writing and orally the students can outline a scientific issue for an expert audience accurately, understandably and in a structured way.
	The students can deal with issues in an expert discussion and answer them in a manner that is appropriate to the addressees. In doing so they
	can uphold their own assessments and viewpoints convincingly.
Autonomy	
Autonomy	The students are capable of structuring an extensive work process in terms of time and of dealing with an issue within a specified time frame.
	The students are able to identify, open up, and connect knowledge and material necessary for working on a scientific problem.
	The students can apply the essential techniques of scientific work to research of their own.
Workload in Hours	Independent Study Time 360, Study Time in Lecture 0
Credit points	12
Examination	according to Subject Specific Regulations
Examination duration and scale	laut FSPO
Assignment for the Following	General Engineering Science (German program): Thesis: Compulsory
Curricula	General Engineering Science (German program, 7 semester): Thesis: Compulsory
	Civil- and Environmental Engineering: Thesis: Compulsory
	Bioprocess Engineering: Thesis: Compulsory
	Computer Science: Thesis: Compulsory
	Electrical Engineering: Thesis: Compulsory
	Energy and Environmental Engineering: Thesis: Compulsory General Engineering Science (English program): Thesis: Compulsory
	General Engineering Science (English program, 7 semester): Thesis: Compulsory
	Computational Science and Engineering: Thesis: Compulsory
	Logistics and Mobility: Thesis: Compulsory
	Mechanical Engineering: Thesis: Compulsory
	Mechatronics: Thesis: Compulsory
	Naval Architecture: Thesis: Compulsory
	Technomathematics: Thesis: Compulsory
	xx: Thesis: Compulsory
	Process Engineering: Thesis: Compulsory