

Module Manual

Bachelor of Science

General Engineering Science (German program)

Cohort: Winter Term 2015

Updated: 28th June 2017

Table of Contents

Table of Conter		2
Program descri	•	5
Core qualificati		6
	Nontechnical Complementary Courses for Bachelors	6
Module M0642: Module M0687:	Physics for Engineers	8 10
	Electrical Engineering I: Direct Current Networks and Electromagnetic Fields	12
	Mechanics I (Statics)	13
Module M0850:	Mathematics I	15
Module M0547:	Electrical Engineering II: Alternating Current Networks and Basic Devices	18
Module M0594:	Fundamentals of Mechanical Engineering Design	21
	Technical Thermodynamics I Mechanics II: Mechanics of Materials	23 25
Module M0851:		27
	Programming in C	30
Module M0959:	Mechanics III (Hydrostatics, Kinematics, Kinetics I)	32
	Technical Thermodynamics II	34
	Computer Engineering	36
Module M0853:	Mathematics III Introduction to Control Systems	39 42
	· · · · · · · · · · · · · · · · · · ·	42
	Structural Analysis I	45
	Reinforced Concrete I	47
	Signals and Systems	49
Module M0706:		51
	Structural Analysis II	53
	Foundations of Management Principles of Building Materials and Building Physics	55
	Steel Structures I	58 60
	Concrete Structures II	62
Module M0755:		64
Module M0728:	Hydraulic Engineering I	66
	Hydraulic Engineering II	68
	Sanitary Engineering	70
	Energy and Enviromental Engineering	73
	Mechanical Engineering: Design Introduction into Energy and Environmental Engineering	73 76
	Fundamentals of Fluid Mechanics	78
	Electrical Machines	80
Module M0618:	Renewables and Energy Systems	82
	Foundations of Management	84
	Measurement Technology for Mechanical and Process Engineers	87
	Environmental Technology	90 92
	Heat and Mass Transfer Thermal Separation Processes	92 94
	Gas and Steam Power Plants	99
		102
Module M0670:		104
		106
		08
		108 110
Module M0634.		112
Module M0680:		114
Module M0960:	Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)	116
Module M1277:		118
Module M1278:		120
Module M0684:	Maahanigal Engineering: Degine	122 124
		127
Module M0662:	Numerical Mathematics I	130
	MED II: Introduction to Biochemistry and Molecular Biology	132
Module M1333:	BIO I: Implants and Fracture Healing	133
		135
		138 139
	Naval Architecture	40
		140
		142
Module M0854:	Mathematics IV	145

Module M0960.	Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)	148
Module M0680:		150
	Stochastics and Ship Dynamics	152
	Computational Fluid Dynamics I	155
	Fundamentals of Ship Structural Design and Analysis	157
	Structural Design and Construction of Ships	160
	Resistance and Propulsion Hydrostatics and Body Plan	162 163
Module M1110:		166
	Bioprocess Engineering	168
	Fundamentals of Process Engineering	168
Module M0937:	Physical Chemistry	170
	Fundamentals of Fluid Mechanics	172
	Biochemistry and Microbiology	174
	Phase Equilibria Thermodynamics Signals and Systems	177
	Foundations of Management	182
	Bioprocess Engineering - Fundamentals	185
	Heat and Mass Transfer	187
	Thermal Separation Processes	189
	Chemical Reaction Engineering	194
	Bioprocess Engineering - Advanced Process and Plant Engineering I	198 200
	Particle Technology and Solids Process Engineering	203
	Electrical Engineering	205
Module M0708:	Electrical Engineering III: Circuit Theory and Transients	205
	Theoretical Electrical Engineering I: Time-Independent Fields	207
	Materials in Electrical Engineering	210
	Signals and Systems	214
	Electrical Engineering IV: Transmission Lines and Research Seminar Electrical Engineering Project Laboratory	216 218
	Mathematics IV	219
	Introduction to Communications and Random Processes	222
Module M0783:	Measurements: Methods and Data Processing	224
be	Theoretical Electrical Engineering II: Time-Dependent Fields	226
	Electronic Devices	229
	Semiconductor Circuit Design Foundations of Management	231 234
	Computer Science	237
	Discrete Algebraic Structures	237
	Objectoriented Programming, Algorithms and Data Structures	238
	Logic, Automata and Formal Languages	240
	Signals and Systems	242
	Foundations of Management	244
	Graph Theory and Optimization Seminars Computer Science and Mathematics	247 249
	Computernetworks and Internet Security	251
	Numerical Mathematics I	253
	Functional Programming	255
	Computer Architecture	257
Module M0971: Module M0727:	Operating Systems	259
	Mechanical Engineering	260 262
	Mashaniaal Engineering, Design	262
	Fundamentals of Materials Science	265
	Electrical Machines	267
	Fundamentals of Production and Quality Management	269
	Signals and Systems	271
Module M0680: Module M0934:	Fluid Dynamics Advanced Materials	273 275
	Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)	277
	Measurement Technology for Mechanical and Process Engineers	279
Module M0829:	Foundations of Management	282
Focus Biomech	nanics	285
	MED I: Introduction to Anatomy	285
	MED I: Introduction to Radiology and Radiation Therapy	287
Module M0662: Module M0684:	Numerical Mathematics I Heat Transfer	289 291
	MED II: Introduction to Biochemistry and Molecular Biology	293
Module M1333:	BIO I: Implants and Fracture Healing	294
	MED II: Introduction to Physiology	296
	BIO I: Experimental Methods in Biomechanics	297
Focus Energy	Advanced Mechanical Fusion day Design	298 298
	Advanced Mechanical Engineering Design	230

Madula M0655: Computational Fluid Dynamics I	201
Module M0655: Computational Fluid Dynamics I Module M0639: Gas and Steam Power Plants	301 303
Module M0009. das and Steam Fower Hans Module M0684: Heat Transfer	306
Module M0004: Heat Hansler Module M1022: Reciprocating Machinery	308
Focus Aircraft Systems Engineering	311
Module M0597: Advanced Mechanical Engineering Design	311
Module M0597: Advanced Mechanical Engineering Design Module M0596: Advanced Mechanical Design Project	314
Module M0390: Advanced Mechanical Design Project Module M1320: Simulation and Design of Mechatronic Systems	316
Module M1320. Simulaton and Design of Mechatoric Systems Module M0599: Integrated Product Development and Lightweight Design	318
Module M0393: Integrated Floddet Development and Lightweight Design	320
Focus Materials in Engineering Sciences	322
Module M0597: Advanced Mechanical Engineering Design	322
Module M0397. Advanced Mechanical Engineering Design Module M0988: Structural Materials	325
Module M0988. Structural Materials Module M0662: Numerical Mathematics I	325
Module M1009: Material Science Laboratory	329
Module M1003: Material Science Laboratory Module M1005: Enhanced Fundamentals of Materials Science	331
Focus Mechatronics	334
Module M0597: Advanced Mechanical Engineering Design Module M0708: Electrical Engineering III: Circuit Theory and Transients	334
	337
Module M1320: Simulation and Design of Mechatronic Systems	339
Module M0777: Semiconductor Circuit Design Module M0854: Mathematics IV	341 344
	344
Focus Product Development and Production	
Module M0597: Advanced Mechanical Engineering Design	347
Module M0596: Advanced Mechanical Design Project	350
Module M0726: Production Technology Module M1009: Material Science Laboratory	352
Module M1009: Material Science Laboratory Module M0599: Integrated Product Development and Lightweight Design	355 357
Focus Theoretical Mechanical Engineering	359
Module M0597: Advanced Mechanical Engineering Design	359
Module M0597: Advanced Mechanical Engineering Design Module M0684: Heat Transfer	362
Module M0004. Real Transfer Module M1320: Simulation and Design of Mechatronic Systems	364
Module M0596: Advanced Mechanical Design Project	366
Module M0395. Advanced Mechanical Design Project Module M0854: Mathematics IV	368
Specialization Process Engineering	371
Module M0886: Fundamentals of Process Engineering	371
Module M0886. Fundamentals of Flocess Engineering Module M0937: Physical Chemistry	373
Module M0337: Fundamentals of Fluid Mechanics	375
Module M0505. Fundamentals of Fluid Mechanics Module M0544: Phase Equilibria Thermodynamics	377
Module M0344: I made Equilibria memodynamics Module M0672: Signals and Systems	380
Module M0972: Olgrads and Oysenis Module M0938: Bioprocess Engineering - Fundamentals	382
Module M1274: Environmental Technology	384
Module M0891: Informatics for Process Engineers	386
Module M0538: Heat and Mass Transfer	389
Module M0546: Thermal Separation Processes	391
Module M0892: Chemical Reaction Engineering	396
Module M1275: Environmental Technology	400
Module M0956: Measurement Technology for Mechanical and Process Engineers	402
Module M0539: Process and Plant Engineering I	405
Module M0670: Particle Technology and Solids Process Engineering	408
Module M0829: Foundations of Management	410
Thesis	413
Module M-001: Bachelor Thesis	413



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, some of them with further specialisations. GES is designed as an intensive course of studies, with a higher workload than 180 credit points. The Bachelor degree in one of the fields of study enables a consecutive study of one of the corresponding Master studyies, 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.

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, some of them with further specialisations. GES is designed as an intensive course of studies, with a higher workload than 180 credit points. The Bachelor degree in one of the fields of study enables a consecutive study of one of the corresponding Master study, 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.

Ξ



Core qualification

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 Elective Study Area
	imparts skills that, in view of the TUHH's training profile, professional engineering studies require but are not able to cover fully. Self-relian management, collaboration and professional and personnel management competences. The department implements these training objective teaching architecture, in its teaching and learning arrangements, in teaching areas and by means of teaching offerings in which students can by opting for specific competences and a competence level at the Bachelor's or Master's level. The teaching offerings are pooled in two 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 "non-technical department" f specific profiling of TUHH degree courses.
	The learning architecture demands and trains independent educational planning as regards the individual development of competences. It also 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 of the adaptation problems that individuals commonly face in their first semesters after making the transition from school to university and in encourage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters during the studies.
	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 interdisc 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, communication stu sustainability research, and from engineering didactics. In addition, from the winter semester 2014/15 students on all Bachelor's courses will 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 comm skills, e.g. the skills required by outgoing engineers in international and intercultural situations.
	The Competence Level
	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 in the practical examples used, in content topics that refer to different professional application contexts, and in the higher scientific and theoretica 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 B 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 spisciences 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 successful manner, justify their decisions on forms of organization and application in practical questions in contexts that go beyond the technical relationsh subject.
Personal Competence	
Social Competence	Personal Competences (Social Skills)
	Students will be able
	to learn to collaborate in different manner,



	 focus would be chosen), 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

Courses

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



Module M0642: Physics for Engineers				
Courses				
Title		Тур	Hrs/wk	CP
Physics for Engineers (L0367)		Lecture	2	3
Physics for Engineers (Problem Solving C	ourse) (L0368)	Recitation Section (small)	1	1
Physics-Lab for ET/ AIW/ GES (L0948)		Laboratory Course	1	2
Module Responsible	Prof. Manfred Eich			
Admission Requirements	None			
Recommended Previous				
Knowledge	Calculus and linear algebra on high school leve			
	Physics on high school level			
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge	Students can explain fundamental topics and laws of pl	nysics such as in the areas of mechanics, oscillation	S,	
	waves, and optics.			
	Students can relate physics topics to technical problem	S.		
Skills	Students can describe physical problems mathematical	ly and solve such problems within the framework of		
	their acquired mathematical expertise.	· /		
	Students are able to write meaningful reports on experi	ments and to discuss the results in a conclusive way	/.	
Personal Competence				
Social Competence				
	within the framework of the problem solving and lab cou			
Autonomy	Students are capable to extract relevant information fro	om the provided references and to relate this infor	mation to the conten	t of the lecture. They ca
	reflect their acquired level of expertise with the help of	of lecture accompanying measures such as exam	typical exam questic	ns. Students are able
	connect their knowledge with that acquired from other le	ectures.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points				
Examination				
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): Core	qualification: Compulsory		
Curricula	Electrical Engineering: Core qualification: Compulsory	• •		
Course L0367: Physics for Enginee	rs			
Тур	Lecture			
Hrs/wk	2			
CP	3			

HIS/WK	2	
CP		
Workload in Hours	dependent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Manfred Eich	
Language	DE	
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	 Giancoli, Physics for Scientists & Engineers Vol. 1, 2, Pearson Halliday/Resnik/Walker, <i>Fundamentals of physics</i>, Wiley K. Cummings, P. Laws, E. Redish, and P. Cooney ("CLRC"), <i>Understanding Physics</i>, Wiley Gerthsen/Vogel, <i>Physik</i>, Springer Verlag Hering/Martin/Stohrer, <i>Physik für Ingenieure</i>, VDI-Verlag 	



Course L0368: Physics for Engineers (Problem Solving Course)	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Manfred Eich
Language	DE
Cycle	WiSe
Content	see lecture Physics for Engineers
Literature	see lecture Physics for Engineers

Course L0948: Physics-Lab for ET/ AIW/ GES		
Тур	Laboratory Course	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Wolfgang Hansen	
Language	DE/EN	
Cycle	SoSe	
Content	In the physics lab a number of key experiments on physical phenomena in mechanics, oscillatory and wave motion, thermodynamics, electricity, and	
	optics will be conducted by the students under assistance of a lecturing tutor. The experiments are part of the physics education program presented in	
	the course "Physics for TUHH-ET Engineers".	
	Beyond teaching of fundamental physical background the objectives are basic skills in preparation and performing physical measurements, usage of	
	physical equipment, analysis of the results and preparation of a report on the experimental data.	
Literature	Zu den Versuchen gibt es individuelle Versuchsanleitungen, die vor der Versuchsdurchführung ausgegeben werden.	
	Zum Teil müssen die zur Versuchsdurchführung notwendigen physikalischen Hintergründe selbstständig erarbeitet werden, wozu die zur Vorlesung	
	"Physik für TUHH-ET Ingenieure" angegebene Literatur gut geeignet ist.	

Module Manual B. Sc. "General Engineering Science (German program)"



Module M0687: Chemistry				
Module Mooor. Chemistry				
Courses				
Title		Тур	Hrs/wk	CP
Chemistry I (L0460)		Lecture	2	2
Chemistry I (L0475)		Recitation Section (large)	1	1
Chemistry II (L0465)		Lecture	2	2
Chemistry II (L0476)		Recitation Section (large)	1	1
Module Responsible	NN			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following lea	rning results		
Professional Competence				
Knowledge	The students are able to name and to describe basic principles ar	nd applications of general chemistry	(structure of matter,	periodic table, chemica
-	bonds), physical chemistry (aggregate states, separating process	es, thermodynamics, kinetics), inor	ganic chemistry (aci	d/base, pH-value, salts
	solubility, redox, metals) and organic chemistry (aliphatic hydrocar	rbons, functional groups, carbonyl c	ompounds, aromate	s, reaction mechanism
	natural products, synthetic polymers). Furthermore students are able t			-,
Skills	After successful completion of this module students are able to descri explaining, choosing and applying specific methods and various reac	• •	ompounds. On this b	asis, they are capable
Personal Competence				
Social Competence	Students are able to take part in discussions on chemical issues and	d problems as a member of an interd	isciplinary team. The	y can contribute to thos
	discussion by their own statements.			
Autonomy	After successful completion of this module students are able to so	lve chemical problems independen	tly by defending pro	posed approaches wit
hatehenny	arguments. They can also document their approaches.		if by detending pre	posed approaches wit
	arguments. They can also document their approaches.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
	General Engineering Science (German program): Core qualification: (
Assignment for the Following	General Engineering Science (Gennan Diourani). Core duanication.	Compulsory		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Core qualification: Compulsory			

Course L0460: Chemistry I		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer		
Language	DE	
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	- Blumenthal, Linke, Vieth: Chemie - Grundwissen für Ingenieure	
	- Kickelbick: Chemie für Ingenieure (Pearson)	
	- Mortimer: Chemie. Basiswissen der Chemie.	
	- Brown, LeMay, Bursten: Chemie. Studieren kompakt.	



Course L0475: Chemistry I	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Dorothea Rechtenbach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0	Course L0465: Chemistry II		
Тур	Lecture		
Hrs/wk	2		
CP	2		
Workload	Independent Study Time 32, Study Time in Lecture 28		
in Hours			
Lecturer	Dr. Christoph Wutz		
Language	DE		
Cycle	WiSe		
Content	- 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	- Blumenthal, Linke, Vieth: Chemie - Grundwissen für Ingenieure		
	- Kickelbick: Chemie für Ingenieure (Pearson)		
	- Schmuck: Basisbuch Organische Chemie (Pearson)		

Course L0476: Chemistry II		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Dorothea Rechtenbach	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0743: Electrical Engineering I: Direct Current Networks and Electromagnetic Fields				
Courses				
Title		Тур	Hrs/wk	CP
Electrical Engineering I: Direct Current Ne	tworks and Electromagnetic Fields (L0675)	Lecture	3	5
Electrical Engineering I: Direct Current Ne	tworks and Electromagnetic Fields (L0676)	Recitation Section (small)	2	1
Module Responsible	Prof. Manfred Kasper			
Admission Requirements	None			
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students have reached the foll	owing learning results		
Professional Competence				
Knowledge				
Skills				
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	zweistündig			
Assignment for the Following	General Engineering Science (German program): Core qua	lification: Compulsory		
Curricula	Electrical Engineering: Core qualification: Compulsory			
	Computational Science and Engineering: Core qualification	: Compulsory		
	Mechatronics: Core qualification: Compulsory			

Course L0675: Electrical Engineering I: Direct Current Networks and Electromagnetic Fields		
Тур	Lecture	
Hrs/wk	3	
CP	5	
Workload in Hours	Independent Study Time 108, Study Time in Lecture 42	
Lecturer	Prof. Manfred Kasper	
Language	DE	
Cycle	WiSe	
Content		
Literature	 M. Kasper, Skript zur Vorlesung Elektrotechnik 1, 2013 M. Albach: Grundlagen der Elektrotechnik 1, Pearson Education, 2004 F. Moeller, H. Frohne, K.H. Löcherer, H. Müller: Grundlagen der Elektrotechnik, Teubner, 2005 A. R. Hambley: Electrical Engineering, Principles and Applications, Pearson Education, 2008 	

Course L0676: Electrical Engineering I: Direct Current Networks and Electromagnetic Fields		
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	DE	
Cycle	WiSe	
Content		
Literature	1. Übungsaufgaben zur Elektrotechnik 1, TUHH, 2013 2. Ch. Kautz: Tutorien zur Elektrotechnik, Pearson Studium, 2010	



ourses				
itle		Тур	Hrs/wk	CP
lechanics I (Statics) (L1001)		Lecture	2	3
Mechanics I (Statics) (L1002)		Recitation Section (small)	2	2
lechanics I (Statics) (L1003)		Recitation Section (large)	1	1
Module Responsible	Prof. Robert Seifried			
Admission Requirements	none			
Recommended Previous	Elementary knowledge in mathematics and physi	CS		
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ned the following learning results		
Professional Competence				
Knowledge	The students can			
	 describe the axiomatic procedure used in 	mochanical contexts		
	 explain important steps in model design; 	mechanical contexts,		
	 present technical knowledge in stereostati 	ing		
	present technical knowledge in stereostati	ius.		
Skills	The students can			
		atical / mechanical analysis and model formation, and ap	ply it to the context of	their own problems
	apply bable claubal motilede le engineerin	cal methods and extend them to be applicable to wider pi	rahlam aata	
	 estimate the reach and boundaries of stati 	carmetrious and extend them to be applicable to wider pr	obienti sets.	
Personal Competence				
Social Competence	The students can work in groups and support eac	h other to overcome difficulties.		
Autonomy	Students are capable of determining their own str	engths and weaknesses and to organize their time and le	arning based on thos	.е.
Workload in Hours	Independent Study Time 110, Study Time in Lectu	ure 70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program)	: Core qualification: Compulsory		
Curricula	Civil- and Environmental Engineering: Core quali	fication: Compulsory		
	Mechanical Engineering: Core qualification: Com	pulsory		
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core gualification: Compulsor	v		

Course L1001: Mechanics I (Statics	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Robert Seifried
Language	DE
Cycle	WiSe
Content	Forces and equilibrium
	Constraints and reactions
	Frames
	Center of mass
	Friction
	Internal forces and moments for beams
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. 11. Auflage, Springer (2011).

Course L1002: Mechanics I (Statics)
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	WiSe
Content	Forces and equilibrium
	Constraints and reactions
	Frames
	Center of mass
	Friction
	Internal forces and moments for beams
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. 11. Auflage, Springer (2011).



Course L1003: Mechanics I (Statics))
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	WiSe
Content	Forces and equilibrium
	Constraints and reactions
	Frames
	Center of mass
	Friction
	Internal forces and moments for beams
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. 11. Auflage, Springer (2011).



Mathematics I Second Colspan="4">Typ Hrs/wk CP ysis I (L1010) Lecture 2 2 ysis I (L1012) Recitation Section (small) 1 1 ysis I (L1013) Recitation Section (large) 1 1 ar Algebra I (L0912) Lecture 2 2 ar Algebra I (L0913) Recitation Section (small) 1 1 ar Algebra I (L0914) Recitation Section (large) 1 1 Module Responsibile Prof. Anusch Taraz Prof. 1 1
Part Part Part Part Part Part Part Part
Jysis I (L1010) Lecture 2 2 lysis I (L1012) Recitation Section (small) 1 1 lysis I (L1013) Recitation Section (large) 1 1 ar Algebra I (L0912) Lecture 2 2 ar Algebra I (L0913) Recitation Section (small) 1 1 ar Algebra I (L0914) Recitation Section (large) 1 1
Vysis I (L1012) Recitation Section (small) 1 1 lysis I (L1013) Recitation Section (large) 1 1 ar Algebra I (L0912) Lecture 2 2 ar Algebra I (L0913) Recitation Section (small) 1 1 ar Algebra I (L0914) Recitation Section (large) 1 1
Agebra I (L0913) Recitation Section (large) 1 1 ar Algebra I (L0912) Lecture 2 2 ar Algebra I (L0913) Recitation Section (small) 1 1 ar Algebra I (L0914) Recitation Section (large) 1 1
ar Algebra I (L0912) Lecture 2 2 ar Algebra I (L0913) Recitation Section (small) 1 1 ar Algebra I (L0914) Recitation Section (large) 1 1
ar Algebra I (L0913)Recitation Section (small)11ar Algebra I (L0914)Recitation Section (large)11
ar Algebra I (L0914) Recitation Section (large) 1 1
Module Responsible Prof. Anusch Taraz
Admission Requirements none
Recommended Previous School mathematics
Knowledge
Educational Objectives After taking part successfully, students have reached the following learning results
Professional Competence
Knowledge
Students can name the basic concepts in analysis and linear algebra. They are able to explain them using appropriate examples.
 Students can discuss logical connections between these concepts. They are capable of illustrating these connections with the help of exam They know proof strategies and can reproduce them
They know proof strategies and can reproduce them.
 Students can model problems in analysis and linear algebra with the help of the concepts studied in this course. Moreover, they are capa
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
Students are able to work together in teams. They are capable to use mathematics as a common language.
• In doing so, they can communicate new concepts according to the needs of their cooperating partners. Moreover, they can design examp
check and deepen the understanding of their peers.
Autonomy
Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and
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 128, Study Time in Lecture 112
Credit points 8
Examination Written exam
Examination duration and scale 60 min (Analysis I) + 60 min (Linear Algebra I)
Assignment for the Following General Engineering Science (German program): Core qualification: Compulsory
Curricula Civil- and Environmental Engineering: Core qualification: Compulsory
Bioprocess Engineering: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory
Energy and Environmental Engineering: Core qualification: 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
Process Engineering: Core qualification: Compulsory



Course L1010: Analysis I	
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	Foundations of differential and integrational calculus of one variable
	 statements, sets and functions natural and real numbers convergence of sequences and series continuous and differentiable functions mean value theorems Taylor series calculus error analysis fixpoint iteration
Literature	 R. Ansorge, H. J. Oberle: Mathematik für Ingenieure, Band 1. Verlag Wiley-VCH, Berlin, Weinheim, New York, 2000 H.J. Oberle, K. Rothe, Th. Sonar: Mathematik für Ingenieure, Band 3: Aufgaben und Lösungen. Verlag Wiley-VCH, Berlin, Weinheim, New York, 2000.

Course L1012: Analysis I		
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	

urse L1013: Analysis I	
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 L0912: Linear Algebra I		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Anusch Taraz	
Language	DE	
Cycle	WiSe	
Content	 vectors: intuition, rules, inner and cross product, lines and planes general vector spaces: subspaces, isomorphic spaces, Euclidean vector spaces systems of linear equations: Gauß-elimination, matrix product, inverse matrices, transformations, LR-decomposition, block matrices, determinants 	
Literature	 W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 	



Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Anusch Taraz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0914: Linear Algebra I	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Anusch Taraz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Module M0547: Electrical E	ngineering II: Alternating Current Netwo	orks and Basic Devices		
Courses				
ïtle		Тур	Hrs/wk	CP
Electrical Engineering II: Alternating Curre	nt Networks and Basic Devices (L0178)	Lecture	3	5
Electrical Engineering II: Alternating Curren		Recitation Section (small)	2	1
Module Responsible	Prof. Christian Becker			
Admission Requirements	None			
Recommended Previous	Direct current networks, complex numbers			
Knowledge				
Educational Objectives	After taking part successfully, students have reached t	ho following loarning results		
Professional Competence	Alter laking part successionly, subtents have reached t	The following learning results		
Knowledge	Students are able to reproduce and explain fundan	nental theories principles and methods related	to the theory of altern	ating currents. They or
nitowiedge	describe networks of linear elements using a complex			•
	of alternating currents in the area of electrical engine	• • •		
	as well as their impact on simple circuits.			
Skills	Students are capable of calculating parameters within	simple electrical networks at alternating currents	by means of a complex	notation for voltages ar
	currents. They can appraise the fundamental effects the	nat may occur within electrical networks at alternat	ing currents. Students a	are able to analyze simp
	circuits such as oscillating circuits, filter, and matchin	g networks quantitatively and dimension element	s by means of a desig	n. They can motivate ar
	justify the fundamental elements of an electrical power	er supply (transformer, transmission line, compens	ation of reactive power	r, multiphase system) ar
	are qualified to dimension their main features.			
Personal Competence				
Social Competence	Students are able to work together on subject related	tasks in small groups. They are able to present the	ir results effectively (e.c	a. during a week of proie
, ,	work).			,
Autonomy	Students are capable to gather necessary information from the references provided and relate that information to the context of the lecture.		the lecture. They are ab	
	to continually reflect their knowledge by means of act	ivities that accompany the lecture, such as online	tests and exercises that	at are related to the example
	Based on respective feedback, students are expected	ed to adjust their individual learning process. Th	ey are able to draw co	onnections between the
	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 7	0		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 - 150 minutes			
Assignment for the Following	General Engineering Science (German program): Cor	e qualification: Compulsory		
Curricula	Electrical Engineering: Core qualification: Compulsory			
	Computational Science and Engineering: Core qualifi			
	Mechatronics: Core gualification: Compulsory			



Course L0178: Electrical Engineerin	g II: Alternating Current Networks and Basic Devices
Тур	Lecture
Hrs/wk	3
CP	5
Workload in Hours	Independent Study Time 108, Study Time in Lecture 42
Lecturer	Prof. Christian Becker
Language	DE
Cycle	SoSe
Content	- General time-dependency of electrical networks
	- Representation and properties of harmonic signals
	- RLC-elements at alternating currents/voltages
	- Complex notation for the representation of RLC-elements
	- Power in electrical networks at alternating currents, compensation of reactive power
	- Frequency response locus (Nyquist plot) and Bode-diagrams
	- Measurement instrumentation for assessing alternating currents
	- Oscillating circuits, filters, electrical transmission lines
	- Transformers, three-phase current, energy converters
	- Simple non-linear and active electrical devices
Literature	- M. Albach, "Elektrotechnik", Pearson Studium (2011)
	- T. Harriehausen, D. Schwarzenau, "Moeller Grundlagen der Elektrotechnik", Springer (2013)
	- R. Kories, H. Schmidt-Walter, "Taschenbuch der Elektrotechnik", Harri Deutsch (2010)
	- C. Kautz, "Tutorien zur Elektrotechnik", Pearson (2009)
	- A. Hambley, "Electrical Engineering: Principles and Applications", Pearson (2013)
	- R. Dorf, "The Electrical Engineering Handbook", CRC (2006)



Course L0179: Electrical Engineerin	g II: Alternating Current Networks and Basic Devices
Тур	Recitation Section (small)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Christian Becker
Language	DE
Cycle	SoSe
Content	- General time-dependency of electrical networks
	- Representation and properties of harmonic signals
	- RLC-elements at alternating currents/voltages
	- Complex notation for the representation of RLC-elements
	- Power in electrical networks at alternating currents, compensation of reactive power
	- Frequency response locus (Nyquist plot) and Bode-diagrams
	- Measurement instrumentation for assessing alternating currents
	- Oscillating circuits, filters, electrical transmission lines
	- Transformers, three-phase current, energy converters
	- Simple non-linear and active electrical devices
Literature	- M. Albach, "Elektrotechnik", Pearson Studium (2011)
	- T. Harriehausen, D. Schwarzenau, "Moeller Grundlagen der Elektrotechnik", Springer (2013)
	- R. Kories, H. Schmidt-Walter, "Taschenbuch der Elektrotechnik", Harri Deutsch (2010)
	- C. Kautz, "Tutorien zur Elektrotechnik", Pearson (2009)
	- A. Hambley, "Electrical Engineering: Principles and Applications", Pearson (2013)
	- R. Dorf, "The Electrical Engineering Handbook", CRC (2006)

Г

Admission Requirements N Recommended Previous Knowledge Educational Objectives Ad Professional Competence	sign (L0259) rof. Dieter Krause lone • Basic knowledge about mechanics and production engineerin • Internship (Stage I Practical) (fter taking part successfully, students have reached the following lea fter passing the module, students are able to: • explain basic working principles and functions of machine ele • explain requirements, selection criteria, application scenario	arning results	Hrs/wk 2 2	CP 3 3
Fundamentals of Mechanical Engineering Des Fundamentals of Mechanical Engineering Des Module Responsible Pr Admission Requirements No Recommended Previous Knowledge Educational Objectives Af Professional Competence	sign (L0259) rof. Dieter Krause lone • Basic knowledge about mechanics and production engineerin • Internship (Stage I Practical) (fter taking part successfully, students have reached the following lea fter passing the module, students are able to: • explain basic working principles and functions of machine ele • explain requirements, selection criteria, application scenario	Lecture Recitation Section (large)	2	3
Admission Requirements N Recommended Previous Knowledge Educational Objectives Ad Professional Competence	Ione Basic knowledge about mechanics and production engineerin Internship (Stage I Practical) Ifter taking part successfully, students have reached the following leaf Ifter passing the module, students are able to: explain basic working principles and functions of machine ele explain requirements, selection criteria, application scenario	arning results		
Recommended Previous Knowledge Educational Objectives Al Professional Competence	Basic knowledge about mechanics and production engineerin Internship (Stage I Practical) fter taking part successfully, students have reached the following leaf fter passing the module, students are able to: explain basic working principles and functions of machine ele explain requirements, selection criteria, application scenario	arning results		
Knowledge Educational Objectives Ai Professional Competence	 Internship (Stage I Practical) fter taking part successfully, students have reached the following leafter passing the module, students are able to: explain basic working principles and functions of machine elefter explain requirements, selection criteria, application scenario 	arning results		
Professional Competence	 fter passing the module, students are able to: explain basic working principles and functions of machine ele explain requirements, selection criteria, application scenario 			
	 explain basic working principles and functions of machine ele explain requirements, selection criteria, application scenario 			
			machine elements, indic	cate the background of
Skiils Al	dimensioning calculations. After passing the module, students are able to: • 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 technical drawings and schematic sketches, • technically evaluate basic designs.			
Personal Competence Social Competence Autonomy	 Students are able to discuss technical information in the lectu Students are able to independently deepen their acquired knowledge and to lectures. 	owledge in exercises.		rideo recordings of the
Workload in Hours In	ndependent Study Time 124, Study Time in Lecture 56			
Credit points 6				
Examination W	Vritten exam			
Examination duration and scale 12	20			
Assignment for the Following G	eneral Engineering Science (German program): Core qualification:	Compulsory		
Gi La M M	inergy and Environmental Engineering: Core qualification: Compuls eneral Engineering Science (English program): Core qualification: o ogistics and Mobility: Core qualification: Compulsory Mechanical Engineering: Core qualification: Compulsory Mechatronics: Core qualification: Compulsory laval Architecture: Core qualification: Compulsory			



Course L0258: Fundamentals of Me	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Josef Schlattmann, Prof. Otto von Estorff, Prof. Sören Ehlers
Language	DE
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	
	 Dubbel, Taschenbuch f ür 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 L0259: Fundamentals of Mechanical Engineering Design	
Тур	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Josef Schlattmann, Prof. Otto von Estorff, Prof. Sören Ehlers
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0671: Technical T	hermodynamics 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 foll	owing learning results		
Professional Competence				
Knowledge	Students are familiar with the laws of Thermodynamic. The	ev know the relation of the kinds of energy a	cording to 1 st law of	Thermodynamic and are
	-		÷	•
	aware about the limits of energy conversions according to 2 nd law of Thermodynamic. They are able to distinguish between state variables and process			
	variables and know the meaning of different state variables like temperature, enthalpy, entropy and also the meaning of exergy and anergy. They are			
	able to draw the Carnot cycle in a Thermodynamic related diagram. They know the physical difference between an ideal and a real gas and are able to			
	use the related equations of state. They know the meaning of	of a fundamental state of equation and know th	ie basics of two phase	Thermodynamic.
Skills	Students are able to calculate the internal energy, the entha			
	and to use this calculations for the Carnot cycle. They are a	able to calculate state variables for an ideal a	and for a real gas from	measured thermal state
	variables.			
Personal Competence				
Social Competence	The students are able to discuss in small groups and develop an approach.			
Autonomy	Students are able to define independently tasks, to get new	knowledge from existing knowledge as well a	s to find ways to use th	e 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 qua	lification: Compulsory		
Curricula	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification:	Compulsory		
	General Engineering Science (English program): Core qual	ification: Compulsory		
	Computational Science and Engineering: Specialisation En	gineering Sciences: Elective Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation Engineering Science: E	lective Compulsory		
	Process Engineering: Core qualification: Compulsory			



Course L0437: Technical Thermody	namics I
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	SoSe
Content	
	1. Introduction
	2. Fundamental terms
	3. 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	
	Schmitz, G.: Technische Thermodynamik, TuTech Verlag, Hamburg, 2009
	Baehr, H.D.; Kabelac, S.: Thermodynamik, 15. Auflage, Springer Verlag, Berlin 2012
	- Detter M. Corrector C. Thermodynamics for Engineers Mc Crowl III (000
	Potter, M.; Somerton, C.: Thermodynamics for Engineers, Mc GrawHill, 1993

Course 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

ourse 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 M0696: Mechanics II: Mechanics of Materials				
Courses				
Title		Тур	Hrs/wk	CP
Mechanics II (L0493)		Lecture	2	2
Mechanics II (L0494)		Recitation Section (small)	2	2
Mechanics II (L1691)		Recitation Section (large)	2	2
Module Responsible	Prof. Swantje Bargmann			
Admission Requirements	none			
Recommended Previous	Mechanics I			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	The students name the fundamental concepts and laws of static	s such as stresses, strains, Hooke's linear l	aw.	
Skills	The students apply the mathematical/mechanical analysis and r	nodeling.		
	The students apply the fundamental methods of elasto statics to	simply engineering problems.		
	The students estimate the validity and limitations of the introduc	ed methods.		
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	90 min			
Assignment for the Following	General Engineering Science (German program): Core qualifica	ation: Compulsory		
Curricula	Civil- and Environmental Engineering: Core qualification: Comp	oulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			

Course L0493: Mechanics II		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Swantje Bargmann	
Language	DE	
Cycle	SoSe	
Content	stresses and strains	
	Hooke's law	
	tension and compression	
	torsion	
	bending	
	stability	
	buckling	
	energy methods	
Literature	K. Magnus, H.H. Müller -Slany, Grundlagen der Technischen Mechanik. 7. Auflage, Teubner (2005)	
	D. Gross, W. Hauger, W. Schnell, J. Schröder, Technische Mechanik 1&2. 8. Auflage, Springer	
	R.C. Hibbeler, Technische Mechanik	
	1&2. Pearson (2005)	

Course L0494: Mechanics II	Course L0494: Mechanics II	
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Swantje Bargmann	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L1691: Mechanics II	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Swantje Bargmann
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0851: Mathematics	11			
Courses				
Title		Тур	Hrs/wk	CP
Analysis II (L1025)		Lecture	2	2
Analysis II (L1026)		Recitation Section (large)	1	1
Analysis II (L1027)		Recitation Section (small)	1	1
Linear Algebra II (L0915) Linear Algebra II (L0916)		Lecture	2	2
Linear Algebra II (L0917)		Recitation Section (small) Recitation Section (large)	1	1
	Prof. Anusch Taraz	Techalon Section (large)		I
	none			
	Nathematics I			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge				
	Students can name further concepts in analysis and line			
	Students can discuss logical connections between thes	e concepts. They are capable of illustrating t	hese connections wi	th the help of examples.
	They know proof strategies and can reproduce them.			
Skills	Students can model problems in analysis and linear al	aebra with the help of the concepts studied	in this course. More	over, they are capable of
	solving them by applying established methods.	3		, ,
	Students are able to discover and verify further logical of the second sec	connections between the concepts studied in	the course.	
	For a given problem, the students can develop and exe			sults.
	· · · · · · · · · · · · · · · · · · ·			
Personal Competence				
Social Competence				
ecolar competence	Students are able to work together in teams. They are c	apable to use mathematics as a common lan	guage.	
	In doing so, they can communicate new concepts according to the second sec	ording to the needs of their cooperating parts	ners. Moreover, they	can design examples to
	check and deepen the understanding of their peers.			
Autonomy				
	Students are capable of checking their understanding	of complex concepts on their own. They can	n specify open quest	ions precisely and know
	where to get help in solving them.			
	 Students have developed sufficient persistence to be al 	ble to work for longer periods in a goal-orient	ed manner on hard p	problems.
Workload in Hours	ndependent Study Time 128, Study Time in Lecture 112			
Credit points				
· · · · · · ·	, Vritten exam			
	50 min (Analysis II) + 60 min (Linear Algebra II)			
	General Engineering Science (German program): Core qualific	cation: Compulsory		
	Civil- and Environmental Engineering: Core qualification: Com			
	Bioprocess Engineering: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
E	Energy and Environmental Engineering: Core qualification: Co	mpulsory		
c	Computational Science and Engineering: Core qualification: C	ompulsory		
	ogistics and Mobility: Core qualification: Compulsory			
N	Aechanical Engineering: Core qualification: Compulsory			
	Aechatronics: Core qualification: Compulsory			
Ν	Nechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory			



Course L1025: Analysis II	
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	SoSe
Content	 power series and elementary functions interpolation integration (proper integrals, fundamental theorem, integration rules, improper integrals, parameter dependent integrals applications of integration (volume and surface of bodies of revolution, lines and arc length, line integrals numerical quadrature periodic functions
Literature	 R. Ansorge, H. J. Oberle: Mathematik für Ingenieure, Band 1; Verlag Wiley-VCH, Berlin, Weinheim, New York, 2000 H.J. Oberle, K. Rothe, Th. Sonar: Mathematik für Ingenieure, Band 3: Aufgaben und Lösungen; Verlag Wiley-VCH, Berlin, Weinheim, New York, 2000.

Course L1026: Analysis II	
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 L1027: Analysis II	
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 L0915: Linear Algebra II		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Anusch Taraz	
Language	DE	
Cycle	SoSe	
Content	 linear mappings: basis transformation, orthogonal projection, orthogonal matrices, householder matrices linear regression: QR-decomposition, normal equations, linear discrete approximation eigenvalues: diagonalising matrices, normal matrices, symmetric and Hermite matrices, Jordan normal form, singular value decomposition system of linear differential equations 	
Literature	 W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 	



Course L0916: Linear Algebra II	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Anusch Taraz
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0917: Linear Algebra II	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Anusch Taraz
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M1121: Programmi	ng in C				
	-				
Courses		Tur	Unabula	0.0	
Fitle Programming in C (L0083)		Typ Lecture	Hrs/wk	CP 1	
Programming in C (L1488)		Laboratory 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 follo	wing learning results			
Professional Competence					
Knowledge	The students know by heart the basic syntax of C programmin	g as well as its meaning, intent and			
	purpose.				
	They know the fundamental components and principles of ele	mentary procedural programming			
	based on C programming and can explain them:				
	+ basis data types (integers flasting point numbers -t				
	 basic data types (integers, floating point numbers, character advanced data types (pointers, arrays, strings, composed data types) 				
	 operators (arithmetical operations, logical operations, bit op 				
	• 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 lectur	es like object oriented programming in C++.			
Skills	The students know how to use an integrated development en so that they can write, store, compile and execute C programs				
	Using their knowledge they are able to read and understand	given C Programs.			
	They can solve simple algorithmic problems on their own and in C language.	can model and program their solutions			
	The students are able to solve selected exercises from other a mechanics, electrical engineering or physics with the aid of so				
Personal Competence					
Social Competence	The students are able to work in small teams to solve given w programming errors and to present their results.	eekly tasks, to identify and analyze			
	They are able to explain simple phenomena to each other dir	ectly at the PC.			
Autonomy	The students prepare themselves using the given teaching m programming exercises on their own.	aterial and solve the given			
	Additionally, they write small C programs to understand and c gain a certain programming experience.	heck addressed issues and also to			
	For details beyond the scope of the lecture the students inforr literature and / or by supplementary own research.	n themselves using the stated			
Weddeed in Derm	Independent Study Time 20, Study Time in Lastyre 20,				
Workload in Hours Credit points	Independent Study Time 32, Study Time in Lecture 28				
Examination	Homework				
Examination duration and scale	1-2 coding tasks weekly				
Assignment for the Following	General Engineering Science (German program): Core qualit	ication: Compulsory			
Curricula	General Engineering Science (English program): Core qualifi				



Course L0083: Programming in C	
Тур	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Siegfried Rump
Language	DE/EN
Cycle	SoSe
Content	C-Programming:
	 basic data types (integers, floating point numbers, characters, boolean values) 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 (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) important standard libraries and functions (stdio.h, stdlib.h, math.h, string.h, ctype.h, time.h) example programs for technical and mathematical applications
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
	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
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Siegfried Rump
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0959: Mechanics	III (Hydrostatics, Kinematics, Kinetics I)			
Courses				
Title		Тур	Hrs/wk	CP
Mechanics III (Hydrostatics, Kinematics, H	Kinetics I) (L1134)	Lecture	3	3
Mechanics III (Hydrostatics, Kinematics, H	Kinetics I) (L1135)	Recitation Section (small)	2	2
Mechanics III (Hydrostatics, Kinematics, H	Kinetics I) (L1136)	Recitation Section (large)	1	1
Module Responsible	Prof. Robert Seifried			
Admission Requirements	none			
Recommended Previous	Mathematics I, II, Mechanics I (Statics), Mechanics II (Elastostatics)		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The students can			
	 describe the axiomatic procedure used in mechanical con 	to vtc		
	 explain important steps in model design; 	lexis,		
	 present technical knowledge in stereostatics. 			
	• present technical knowledge in stereostatics.			
Skills	The students can			
	explain the important elements of mathematical / mechani	cal analysis and model formation, and a	pply it to the context of	their own problems;
	 apply basic hydrostatical, kinematic and kinetic methods to 	engineering problems;		
	estimate the reach and boundaries of statical methods and	extend them to be applicable to wider p	problem sets.	
Personal Competence				
Social Competence	The students can work in groups and support each other to overce	ome difficulties.		
Autonomy	Students are capable of determining their own strengths and weaknesses and to organize their time and learning based on those.			
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): Core qualificati	on: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Co	re qualification: Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Elec	tive Compulsory		

Course L1134: Mechanics III (Hydrostatics, Kinematics, Kinetics I)		
Тур	cture	
Hrs/wk	3	
CP	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	WiSe	
Content	Hydrostatics	
	Kinematics Kinematics of points and relative motion Motion of point systems and rigid bodies Dynamics Terms Fundamental equations Motion of the rigid body Dynamics of gyroscopes	
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 3 und 4. 11. Auflage, Springer (2011).	

Course L1135: Mechanics III (Hydrostatics, Kinematics, Kinetics I)	
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	WiSe
Content	See interlocking course
Literature	See interlocking course



Course L1136: Mechanics III (Hydrostatics, Kinematics, Kinetics I)	
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	WiSe
Content	See interlocking course
Literature	See interlocking course



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 Tec	hnical Thermodynamics I		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the foll	owing learning results		
Professional Competence		* *		
Knowledge	Students are familiar with different cycle processes like Joul exergetic efficiencies and know the influence different factor cooling cycle). They have increased knowledge of steam of know the laws of gas mixtures, especially of humid air proc knowledge in gas dynamics and know the definition of the s	rs. They know the difference between anti clo- cycles and are able to draw the different cycl esses and are able to perform simple combus	ckwise and clockwise es in Thermodynamic stion calculations. The	cycles (heat-power cyc s related diagrams. Th
Skills	Students are able to use thermodynamic laws for the design of technical processes. Especially they are able to formulate energy, exergy- and eni balances and by this to optimise technical processes. They are able to perform simple safety calculations in regard to an outflowing gas from a They are able to transform a verbal formulated message into an abstract formal procedure.			
Personal Competence Social Competence Autonomy	The students are able to discuss in small groups and develo Students are able to define independently tasks, to get new		s to find ways to use th	ne knowledge in practic
Weddeed's Desse				
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 qua			
Curricula	General Engineering Science (German program, 7 semeste	r): Core qualification: Compulsory		
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification:			
	General Engineering Science (English program): Core qual	ification: Compulsory		
	General Engineering Science (English program, 7 semester	r): Core qualification: Compulsory		
	Computational Science and Engineering: Specialisation En	gineering Sciences: Elective Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science	e: Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsor	У		
	Technomathematics: Core qualification: Elective Compulsor	v		



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



Courses				
Title		Тур	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	e evaluation of the module's examination a	ccording to the followi	ing rules:
	···· · ·······························			
	1. Upon a passed module examination, the student is		rks due to the succes	ssful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively			
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 u	p to 4,0 is not possible.		
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	This module deals with the foundations of the functionality of	computing systems. It covers the layers fro	om the assembly-leve	əl programming dowr
	gates. The module includes the following topics:			
	Introduction			
	Combinational logic: Gates, Boolean algebra, Boolean	functions, hardware synthesis, combination	al networks	
	Sequential logic: Flip-flops, automata, systematic hardw			
	Technological foundations			
	Computer arithmetic: Integer addition, subtraction, multi	plication 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, principation 	bles of passing data, point-to-point connection	ons, busses	
Skills	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 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 ab	le 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 f			
	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 literation	ature and to associate 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 qualific	ation: Compulsory		
Curricula	General Engineering Science (German program, 7 semester):	Specialisation Computer Science: Compulse	ory	
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory			
	General Engineering Science (German program, 7 semester):	Specialisation Naval Architecture: Compulso	ory	
	General Engineering Science (German program, 7 semester):	Specialisation Civil Engineering: Compulso	У	
	General Engineering Science (German program, 7 semester):	Specialisation Electrical Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester):			
	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): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulso			
	General Engineering Science (German program, 7 semester). General Engineering Science (German program, 7 semester).			
	Compulsory	n). Opeolandation Mechanical Engineering	,, i oodo materialo m	Engineering oolen
	General Engineering Science (German program, 7 semeste	r): Specialisation Mechanical Engineering,	Focus Theoretical N	Mechanical Engineer
	Compulsory			3 /0
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering,	Focus Product Devel	opment and Product
	Compulsory			
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, Foc	us Energy Systems: C	Compulsory
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Core qualific			
	General Engineering Science (English program, 7 semester): 5			
	t (in a set E a sin a set of the set of E a link and set of T a second set).	Specialisation Bioprocess Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester): S	Specialisation Naval Architecture: Compulso		
	General Engineering Science (English program, 7 semester): \$ General Engineering Science (English program, 7 semester): \$	Specialisation Naval Architecture: Compulso Specialisation Civil Engineering: Compulsor	y	
	General Engineering Science (English program, 7 semester): S	Specialisation Naval Architecture: Compulso Specialisation Civil Engineering: Compulsor Specialisation Electrical Engineering: Compu	y ulsory	



General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental 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
Seneral 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
Technomathematics: Specialisation II. Informatics: Elective 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	1. Introduction	
	 Principles of digital design Analog versus Digital Gates and flip-flops Aspects of digital design Integrated cicuits Digital devices Time-to-market 	
	2. Number Systems and Codes	
	 General positional number systems Representation of numbers Binary arithmetic Number and character codes Codes for detecting and correcting errors Codes for serial data transmission Binary prefixes 	
	 3. Digital Circuits Logic signals and gates Logic families CMOS logic CMOS circuits: electrical behavior CMOS input and output structures 	



- Bipolar logic
- CMOS logic families
- CMOS/TLL interfacing

4. Combinational Logic Design (Principles)

- Switching algebra
- Combinational-circuit analysis
- Combinational-circuit synthesis
- Minimization
- Timing hazards

5. Combinational Logic Design (Practices)

- Documentation standards
- Timing of digital circuits
- Decoders and encoders
- Three-state devices
- Multiplexers and demultiplexers
- Exclusive-OR gates and parity circuits
- Comparators
- Adders and subtractors
- Combinational multiplier
- Barrel shifter
- Arithmetic and logic unit (ALU)

6. Sequential Logic Design (Principles)

- State concept and clock signal
- Bistable elements
- Asynchronous latches
- Synchronous latches
- Synchronous flip-flops
- Overview: latches and flip-flops
- Clocked synchronous state-machine analysis
- Clocked synchronous state-machine design
- Designing state machines using state diagrams
- Sequential-circuit design with VHDL
- Decomposing state machines

7. Sequential Logic Design (Practices)

- Sequential-circuit documentation standards
- Latches and flip-flops
- Counters
- Shift registers
- Iterative versus sequential circuits
- Synchronous design methodology
- Impediments to synchronous design

8. Memory, PLDs, CPLDs und FPGAs

- ROM, SRAM, DRAM, SDRAM
- Programmable logic devices (PLDs)
- Complex programmable logic devices (CPLDs)
- Field-programmable gate arrays (FPGAs)

9. Microprocessor Technology (Principles)

- Computer history
 - Von Neumann architecture
 - Von Neumann architecture
 Components of a microprocessor system
- Literature
 S. Voigt, Skript zur Vorlesung "Technische Informatik"
 - J. Wakerly, Digital Design: Principles and Practices, 4. Auflage, 2010, Pearson Prentice Hall, ISBN: 978-0-13-613987-4
 - D. Hoffmann, Grundlagen der Technischen Informatik, 2. Auflage, 2010, Carl Hanser Verlag, ISBN: 978-3-446-42150-9



Module M0853: Mathematic	s III			
Courses				
Title		Тур	Hrs/wk	CP
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	tial Equations) (L1032)	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	following learning results		
Professional Competence				
Knowledge	• Chulante con some the basis concerts in the	The standard differential equations. The	ava abla ta avalai:	
	 Students can name the basic concepts in the a 	area of analysis and differential equations. They	are able to explain	i them using appropria
	examples.			
	 Students can discuss logical connections between 	n these concepts. They are capable of illustrating	these connections w	ith the help of examples
	 They know proof strategies and can reproduce th 	em.		
Skills				
Skiiis	 Students can model problems in the area of ana 	alysis and differential equations with the help of the	ne concepts studied	in this course. Moreove
	they are capable of solving them by applying esta			
	 Students are able to discover and verify further lo 		the course	
	 For a given problem, the students can develop an 	id execute a suitable approach, and are able to cri	tically evaluate the re	esults.
Personal Competence				
Social Competence				
Social Competence	 Students are able to work together in teams. They 	are capable to use mathematics as a common lar	nguage.	
	 In doing so, they can communicate new concept 	s according to the needs of their cooperating part	ners. Moreover. they	/ can design examples
	check and deepen the understanding of their pee		, ,	
Autonomy	 Students are conchine of checking their understep 	ading of complex concepts on their own. They are	n anaolfy anon augo	tions presidely and kno
	Students are capable of checking their understat	nding of complex concepts on their own. They ca	n specily open ques	ations precisely and kno
	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 112			
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 of	ualification: Compulsory		
Curricula	General Engineering Science (German program, 7 seme	ster): Core qualification: 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			
		ualification: Compulsory		
	General Engineering Science (English program): Core q	uanication. Computiony		
	General Engineering Science (English program): Core q General Engineering Science (English program, 7 seme:			
	General Engineering Science (English program, 7 seme	ster): Core qualification: Compulsory		
	General Engineering Science (English program, 7 seme Computational Science and Engineering: Core qualificat	ster): Core qualification: Compulsory ion: Compulsory		
	General Engineering Science (English program, 7 seme Computational Science and Engineering: Core qualificat Mechanical Engineering: Core qualification: Compulsory	ster): Core qualification: Compulsory ion: Compulsory		
	General Engineering Science (English program, 7 seme Computational Science and Engineering: Core qualificat Mechanical Engineering: Core qualification: Compulsory Mechatronics: Core qualification: Compulsory	ster): Core qualification: Compulsory ion: Compulsory		
	General Engineering Science (English program, 7 seme Computational Science and Engineering: Core qualificat Mechanical Engineering: Core qualification: Compulsory	ster): Core qualification: Compulsory ion: 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 Equations 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	
liberatura	 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 Equation	is 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		



)		
Courses		
ïtle	Typ Hrs/wk CP	
ntroduction to Control Systems (L0654)	Lecture 2 4	
ntroduction 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 properties of first and s 	ocond or
	 Students can represent dynamic system behavior in time and requency domain, and can in particular explain properties of instand s systems 	econd on
	 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 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	
Dereenal Competence		
Personal Competence	Ctudente con work in amall groups to jointly colve to bridge local and avaid importally validate their controller decision	
Social Competence	Students can work in small groups to jointly solve technical problems, and experimentally validate their controller designs	oluina ai
Autonomy	Students can obtain information from provided sources (lecture notes, software documentation, experiment guides) and use it when so problems.	olving 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	0	
	Written exem	
	Written exam	
Examination duration and scale	120 min	
Examination duration and scale Assignment for the Following	120 min General Engineering Science (German program): Core qualification: Compulsory	
Examination duration and scale	120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
Examination duration and scale Assignment for the Following	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 duration and scale Assignment for the Following	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 duration and scale Assignment for the Following	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 duration and scale Assignment for the Following	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	
Examination duration and scale Assignment for the Following	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	
Examination duration and scale Assignment for the Following	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 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 General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory	
Examination duration and scale Assignment for the Following	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	
Examination duration and scale Assignment for the Following	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 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 General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	
Examination duration and scale Assignment for the Following	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 Mechanical 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; 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	Compulss
Examination duration and scale Assignment for the Following	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 Mechanical 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 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 Aircr	
Examination duration and scale Assignment for the Following	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 Mechanical 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; 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	
Examination duration and scale Assignment for the Following	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 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 Micraft Systems Engineering: General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: General Engineering,	g Scienc
Examination duration and scale Assignment for the Following	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 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: General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft 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: General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: General Engineering Science (German program, 7 semester): Specialisation Mecha	g Scienc
Examination duration and scale Assignment for the Following	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 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: C 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 Materials in Engineering Compulsory	g Scienc
Examination duration and scale Assignment for the Following	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 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; 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 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 Compulsory	g Scienc
Examination duration and scale Assignment for the Following	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 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; 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: C 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, Focus Theoretical Mechanical Engineering, Focus Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Developm	g Scienc
Examination duration and scale Assignment for the Following	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 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 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: C 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 En	g Scienc
Examination duration and scale Assignment for the Following	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 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 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 Compulsory General Engineer	g Scienc
Examination duration and scale Assignment for the Following	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 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 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 Compulsory	g Scienc
Examination duration and scale Assignment for the Following	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 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 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: C General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: C 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 E Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical E Compulsory General Engine	g Scienc Engineeri
Examination duration and scale Assignment for the Following	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 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 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 Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Bioprocess Engineering Science (Ger	g Scienc
Examination duration and scale Assignment for the Following	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 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 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 Aircraft Systems Engineering: 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 Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical E Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical E Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Compulsory General Engineering	g Scienc
Examination duration and scale Assignment for the Following	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 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 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 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 Meterials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Bioproces	g Scienc
Examination duration and scale Assignment for the Following	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 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 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 Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: 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 F Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical F Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Bioprocess Engineering S	g Scienc
Examination duration and scale Assignment for the Following	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 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 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 Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Compulsory General Engineering: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory Electrical Engineering: Core quali	g Scienc
Examination duration and scale Assignment for the Following	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 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 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 Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Co	g Scienc Engineeri
Examination duration and scale Assignment for the Following	120 min 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 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 Diomedical 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: 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, Focus Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foc	g Scienc



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

Typ Lecture Hrstwh Z OP 4 Independent Study Time 92, Study Time in Lecture 28 Lacture Poil. Herbert Werner Language DE Cycle WSie Content Signala and systems. I.Inser systems, differential equations and transfer functions • Inser systems. First and second order systems, poles and zeros, impulse and step response • Stability Feedback systems • Order systems in the step of stability. Feedback systems • Principle of feedback.open-loop versus closed-loop control. • Type of feedback.PID control • System type and steady state error.error constants • Internal model principle Root locus techniques • Root locus techniques • Root locus techniques • Root locus design of PID control lers Requency response techniques • Root locus design of ID control lers • Requency response techniques • Root locus design of PID control lers • Requency response techniques • Root locus design of ID control lers • Requency response of time delay systems • Root locus and frequency response of time delay systems • Simility certerion.phase and gain margin • Root locus and frequenory response of time de	Course L0654: Introduction to Contr	rol Systems
Hrawk 2 OP 4 Worklead In Mour Independent Study Time 92, Study Time in Lecture 28 Lacture Prot. Hetendr Werner Language DE Octed WiSe Content Signals and systems Linear systems, differential equations and transfer functions First and second order systems, poles and zoros, impulse and step response Stability Feedback systems Protople of deback, pop-loop versus closed-loop control Reference tracking and disturbance rejection Types of leedback, pop-loop versus closed-loop control Reference tracking and disturbance rejection Types of leedback, PLO control System type and debady-state error, error constants Internal model principle Root locus lechniques Root locus lechniques Root locus plots Root locus lechniques Bode diagram Minimum and non-minimum phase systems Internal concelling and goorgenesation Frequency response techniques Root locus and frequency response of time delay systems Smith predictor Digital control Time delay systems Smith predictor Digital control Sampled-data systems, difference equations Tust approximation, digital implementation of PID controllers Schware bols Introduction to Matab, Simulink, Control toobox Computer-based exencises throughout the course <th></th> <th></th>		
Workload in Hours Independent Study Time 92, Study Time in Lecture 28 Languag DE Oyde WiSe Content Signals and systems Linear systems, oliferential equations and transfer functions Ent and second order systems, poles and zeros, impulse and step response Subility Feedback systems Principle of leedback, open-loop versus closed-loop control Reference tracking and disturbance rejection Yopes of leedback, PD control System type and steady-stem error, error constants Internal model principle Root locus techniques Root cous techniques Root locus techniques Root locus degin of PID control ters Root locus techniques <th></th> <th></th>		
Lecture Prof. Herbert Werner Cycyce Wils Contern Signals and systems Linear systems, differential equations and transfer functions First and second order systems, poles and zeros, impulse and step response Stability Peedback 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 betchiques Root locus design of PID controllers Frequency response techniques Bode diagram Minimum phase systems Nyquist plot, Nyquist stability orderion, phase and gain margin Loog shaping, load lag compensation Frequency response techniques Bode locus and frequency response of time delay systems Sont locus and frequency response of time delay systems Sont locus and frequency response of time delay systems Sont locus and frequency response of time delay systems Sont locus and frequency response of time delay systems Sont locus and frequency response of time delay systems Singla control Sampled data systems, difference equations Tusts an approximation, digital implementation of PID controllers Software tools Introduction to Mafab, Simulink, Co	CP	4
Language DE Cycle Wise Content Signals and systems Innear 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 distubance rejection Types of feedback, PID control System type and steady-state error, error constants Internal model principle Root locus feedback (PID control error Bode diagram Minimum and non-minimum phase systems Nyulait plot, Nyulait tability criterion, phase and gain margin Loop shaping, Iadal ga componention Frequency response interpretation of PID control Time delay systems Somith predictor Digital control Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers Software tools Introduction to Maftab, Simulink, Control toolbox Computer-baseed exerclises throughout the course Software too	Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Ope 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 distrance rejection Types of feedback, PIO control System type and steady-state error, error constants Internal model principle Root locus techniques Root locus techniques 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 techniques Root locus and frequency response of fime delay systems Sing predictor	Lecturer	Prof. Herbert Werner
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 Reference tracking and disturbance rejection Types of teedback, PID control System type and steady-state error, error constants Internal model principle Root locus techniques Root locus design of PID controllers Frequency response techniques Bode diagram Minimum and non-minimum phase systems Nyukis tability orferion, phase and gain margin Loop shaping, lead tag 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 exercices throughout the course 	Language	DE
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 diaturbance rejection Types of feedback, PID control System type and deady-state error, error constants Internal model principle Root locus techniques Root locus techniques Root locus techniques Bode diagram Minimum and non-minimum phase systems Nayquist plot, Nquist stability criterion, phase and gain margin Loop shaping, lead lag compensation Frequency response of time delay systems Simility modified Software tools Software tools Introduction to Matiab, Simulink, Control toolbox	Cycle	WiSe
 First and second order systems, poles and zeros, impulse and step response Stability Feedback systems Principle of feedback, open-loop versus closed-loop control Referement tracking and disturbance rejection Types of feedback, pith control System type and steady-state error, error constants Internal model principle Root locus techniques Root locus design of PID controllers Frequency response techniques Bode diagram Minimum and non-minimum phase systems Nequiti tot, 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 	Content	Signals and systems
 Types of feedback, PID control System type and steady-state error, error constants Internal model principle Root locus techniques 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 Software tools Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers Software tools Introduction to Mattab, Simulink, Control toolbox Computer-based exercises throughout the course 		 First and second order systems, poles and zeros, impulse and step response Stability Feedback systems Principle of feedback, open-loop versus closed-loop control
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		 Types of feedback, PID control System type and steady-state error, error constants
 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 		Root locus 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 		
 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 		Frequency response techniques
 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 		 Minimum and non-minimum phase systems Nyquist plot, Nyquist stability criterion, phase and gain margin Loop shaping, lead lag compensation
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		Root locus and frequency response of time delay systems
Tustin approximation, digital implementation of PID controllers Software tools Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course		
 Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course 		
Computer-based exercises throughout the course		Software tools
 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 	Literature	 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	



Specialization Civil- and Enviromental Engeneering

Module M0740: Structural	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 learning	results		
Professional Competence				
Knowledge	After successfully completing this module, students can express the basic aspects of linear frame analysis of statically determinate systems.			
01.114				
Skills	After successful completion of this module, the students are able to distinguish between statically determinate and indeterminate structures. They are			
	able to analyze state variables and to construct influence lines of statically of	determinate plane and spatial frame a	and truss structures	•
Personal Competence				
Social Competence				
Autonomy	The students are able work in-term homework assignments. Due to the in-	term feedback, they are enabled to s	elf-assess their lea	rning progress during
	the lecture period, already.			01 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 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisation Civil- and	Enviromental Engeneering: Compuls	sory	
Curricula	General Engineering Science (German program, 7 semester): Specialisation	on Civil Engineering: Compulsory		
	Civil- and Environmental Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Civil- and I		ory	
	General Engineering Science (English program, 7 semester): Specialisation			
	Technomathematics: Specialisation III. Engineering Science: Elective Comp	oulsory		

Course L0666: Structural Analysis	
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	WiSe
Content	 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 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	ls.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fol	lowing learning results		
Professional Competence				
Knowledge	The students can outline the history of concrete constructi	on and explain the basics of structural engine	ering, including usua	I load combinations and
	safety concepts. They are able to draft and dimension si	mple structures, as well as to evaluate and o	discuss the behaviou	r of the materials and o
	structural members.			
Skills	The students are able to apply basic procedures of the c	onception and dimensioning to practical case	es. They are capable	to draft simple concrete
entite	structures and to design them for bending and bending wit			
	construction sketches and draw up technical descriptions.	n axial lorde, and to plan their detailing and ex		cy can make design and
Personal Competence				
Social Competence	The students are chickly as we sub-transfer to the second		i a a lla sua fi a at tha a sua a sub	-
Autonomy	The students are able to carry out simple tasks in the conce	puon and dimensioning of structures and to crit	ically reliect the result	.5.
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	ation Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semeste	er): Specialisation Civil Engineering: Compulso	ry	
	Civil- and Environmental Engineering: Core qualification: C	ompulsory		
	General Engineering Science (English program): Specialisa	ation Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (English program, 7 semeste	r): Specialisation Civil Engineering: Compulsor	y .	
			-	

Course L0896: Project Seminar Cor	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 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	



	Hrs/wk	CP
	3	4
ction (large)	1	2
maths as covered by the		
ce transform) is useful b	but not required	
tems using methods of s	signal and syst	em theory. They are a
nd systems. They can de	• •	
stand the effects in time		
	o domain and	inago domain inion
ariant systems using me	ethods of signal	and system theory. T
de and phase response,	-	
ie and phase response,	s, stability, intea	nty etc They can ass
as Thoy can control the	oir lovel of know	vladaa durina tha laat
es. They can control the		vieuge during the lect
Compulsory		
npulsory		
ompulsory		
g: Compulsory		
Engeneering: Compulse	sory	
g: Compulsory		
g: Compulsory		
ngineering: Compulsory	У	
Science: Compulsory		
gineering: Compulsory		
Engineering: Compulso		
Engineering: Compulso		
I Engineering, Focus Bio		
I Engineering, Focus En		
I Engineering, Focus Air		
inical Engineering, Foc	cus Materiais II	n Engineering Scienc
E. S. E. M.		
I Engineering, Focus Me		
nical Engineering, Focu	us ineoretical	viecnanical Engineer
Engonocring: Come		
Engeneering: Compulso : Compulsory	ioi y	
: Compulsory Compulsory		
npulsory g: Compulsory		
: Compulsory		
ompulsory ngineering: Compulsory		
cience: Compulsory	/	
gineering: Compulsory		
Engineering: Compulsory	orv	
Engineering: Compulso	•	
Engineering, Focus Bio	•	mpulsory
Engineering, Focus Engineering, Focus Engineering, Focus Eng		
Engineering, Focus Airo		
nical Engineering, Foci	Jub ivialerials II	Lugineering Scien
Engineering Ecous Ma	chatronico: Co-	nnulson
icai Liigineening, Focu	as meoretical	viechanicai Engineen
		ngineering, Focus Mechatronics: Cor al Engineering, Focus Theoretical I



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	
Typ 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	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		
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 M0706: Geotechnic	is I			
Courses				
Title		Тур	Hrs/wk	CP
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	e Masharina I II			
	Mechanics I-II			
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	The students know the basics of soil mechanics as th	e structure and characteristics of soil, stress di	stribution due to we	ight, water or structures,
	consolidation and settlement calculations, as well as failu	ire of the soil due to ground- or slope failure.		
Skills	After the successful completion of the module the studer	nts should be able to describe the mechanical pro	operties and to evalu	ate them with the help of
	geotechnical standard tests. They can calculate stresses	and deformation in the soils due to weight or influ	ience of structures. T	hey 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): Specia	lisation Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 seme	ster): Specialisation Civil Engineering: Compulsor	у	
	Civil- and Environmental Engineering: Core qualification	: Compulsory		
	General Engineering Science (English program): Special	lisation Civil- and Enviromental Engeneering: Con	npulsory	
	General Engineering Science (English program, 7 semes	ster): Specialisation Civil Engineering: Compulsor	у	

Course L0550: Soil Mechanics		
Тур	Lecture	
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	 Structure of the soil Ground surveying Compstittion 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 	



itation Section (large)
pendent Study Time 32, Study Time in Lecture 28
. Jürgen Grabe
e
interlocking course
interlocking course
. Ji e in

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 M0744: Structural Analysis II				
Courses				
Title		Тур	Hrs/wk	CP
Structural Analysis II (L0673)		Lecture	2	3
Structural Analysis II (L0674)		Recitation Section (large)	2	3
Module Responsible	Prof. Uwe Starossek		-	0
Admission Requirements	None			
Recommended Previous	None			
Knowledge	Mechanics I/II			
Knowledge	Mathematics I/II			
	Differential Equations I			
	Structural Analysis I			
Educational Objectives	After taking part successfully, students have reached the fol	lowing learning results		
Professional Competence				
Knowledge	After successful completion of this module, students can exp	press the basic aspects of linear frame analysis	of statically indetermi	nate systems.
Skills	After successful completion of this module, the students are	able to analyze state variables and to construe	t influence lines of sta	tically inderminate pla
	and spatial frame and truss structures.			
Personal Competence				
Social Competence				
Autonomy	The students are able to work in-term homework assignment	nents. Due to the in-term feedback, they are e	enabled to self-assess	s their learning progre
	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): Specialis	ation Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semester	er): Specialisation Civil Engineering: Compulso	ry	
	Civil- and Environmental Engineering: Core qualification: C	compulsory		
	General Engineering Science (English program): Specialis	ation Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (English program, 7 semeste			

Course L0673: Structural Analysis	ll de la constant de		
Тур	Lecture		
Hrs/wk	2		
CP			
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	ourse L0674: Structural Analysis II	
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	



ourses				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880) roject Entrepreneurship (L0882)		Lecture Problem-based Learning	3 2	3 3
Module Responsible	Prof. Christoph Ihl	Troblem-based Learning	2	5
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge	Dasie Miowiedge of Mathematics and Dusiness			
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 m	any different areas in Business and Mar	nagement, from Planr	ning and Organisation
Ū	Marketing and Innovation, and also to Investment and Controlling.		0	0 0
	· · · · · · · · · · · · · · · · · · ·			
	explain the differences between Economics and Managem	ent and the sub-disciplines in Managem	ent and to name impo	ortant definitions from t
	field of Management	ment and name the meet important can	oto of optropypourial r	rejecto
	 explain the most important aspects of and goals in Manage describe and explain basic business functions as productions 			•
	ressource management, information management, innovat		chain management, t	ngamzation and nun
	 explain the relevance of planning and decision making in 		Itiple objectives and	uncertainty, and expl
	some basic methods from mathematical Finance			
	state basics from accounting and costing and selected con	rolling methods.		
Skills	Students are able to analyse business units with respect to	different criteria (organization, objec	tives, strategies etc.) and to carry out
	Entrepreneurship project in a team. In particular, they are able to			
	analyse Management goals and structure them appropriate	ły		
	analyse organisational and staff structures of companies			
	apply methods for decision making under multiple objective	es, under uncertainty and under risk		
	analyse production and procurement systems and Busines	s information systems		
	 analyse and apply basic methods of marketing 			
	 select and apply basic methods from mathematical finance 			
	 apply basic methods from accounting, costing and controlli 	ng 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 entrepreneu 	rship 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	6			
Examination	Written exam			
Examination duration and scale	90 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisation E	lectrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation C	omputer Science: Compulsory		
	General Engineering Science (German program): Specialisation F	rocess Engineering: Compulsory		
	Opported Engineering Opinger (Opported are grown), Opported institution E	ioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation E			
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E	nergy and Enviromental Engineering: Co	ompulsory	
		с, с с		
	General Engineering Science (German program): Specialisation E	ivil- and Enviromental Engeneering: Cor		
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C	ivil- and Enviromental Engeneering: Con lechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation N	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation E	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory laval Architecture: Compulsory	mpulsory	
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation P General Engineering Science (German program, 7 semester): Specialisation Specialisation P General Engineering Science (German program, 7 semester): Specialisation P	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory laval Architecture: Compulsory cialisation Electrical Engineering: Comp cialisation Process Engineering: Compu	ulsory Isory	
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation M General Engineering Science (German program, 7 semester): Specialisation Speci	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory laval Architecture: Compulsory cialisation Electrical Engineering: Comp cialisation Process Engineering: Compu cialisation Biomedical Engineering: Com	ulsory lsory ıpulsory	
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation M General Engineering Science (German program, 7 semester): Specialisation M	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory laval Architecture: Compulsory cialisation Electrical Engineering: Compu cialisation Process Engineering: Compu cialisation Biomedical Engineering: Compu cialisation Naval Architecture: Compulso	ulsory lsory ıpulsory ıpulsory ıry	
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation D General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory laval Architecture: Compulsory cialisation Electrical Engineering: Compu cialisation Process Engineering: Compu cialisation Biomedical Engineering: Compu cialisation Naval Architecture: Compulso cialisation Computer Science: Compulso	ulsory lsory npulsory ory ory	
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation M General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory laval Architecture: Compulsory cialisation Electrical Engineering: Compu cialisation Process Engineering: Compu cialisation Biomedical Engineering: Compulso cialisation Naval Architecture: Compulso cialisation Computer Science: Compulso cialisation Bioprocess Engineering: Com	ulsory Isory Isory Ipulsory Jry Jry Jpulsory	
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation M General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compu cialisation Process Engineering: Compu cialisation Biomedical Engineering: Compulso cialisation Naval Architecture: Compulso cialisation Computer Science: Compulso cialisation Bioprocess Engineering: Com cialisation Civil Engineering: Compulso	ulsory Isory Isory Ipulsory ory opy Ipulsory y	
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compu cialisation Process Engineering: Compu- cialisation Biomedical Engineering: Compulsor cialisation Naval Architecture: Compulso cialisation Computer Science: Compulso cialisation Bioprocess Engineering: Com cialisation Civil Engineering: Compulsor cialisation Energy and Enviromental Eng	mpulsory Ilsory Isory npulsory ory npulsory y gineering: Compulsor	
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compu cialisation Process Engineering: Compu cialisation Biomedical Engineering: Compulsor cialisation Naval Architecture: Compulso cialisation Computer Science: Compulso cialisation Bioprocess Engineering: Com cialisation Civil Engineering: Compulsor cialisation Energy and Enviromental Engicalisation Mechanical Engineering, Foc	mpulsory ulsory lsory npulsory ory npulsory y jineering: Compulsor us Mechatronics: Cor	npulsory
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compu cialisation Process Engineering: Compu cialisation Biomedical Engineering: Compulsor cialisation Naval Architecture: Compulso cialisation Computer Science: Compulso cialisation Bioprocess Engineering: Com cialisation Civil Engineering: Compulsor cialisation Energy and Enviromental Engicalisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc	ulsory lsory pulsory pry pry pulsory y jineering: Compulsor us Mechatronics: Cor us Biomechanics: Co	npulsory mpulsory
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compu cialisation Process Engineering: Compu cialisation Naval Architecture: Compulsor cialisation Computer Science: Compulso cialisation Bioprocess Engineering: Com cialisation Civil Engineering: Compulsor cialisation Energy and Enviromental Eng cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc	ulsory lsory pulsory pry pry pulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems Ei	npulsory mpulsory ngineering: Compulso
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compu cialisation Process Engineering: Compu cialisation Naval Architecture: Compulsor cialisation Computer Science: Compulso cialisation Bioprocess Engineering: Com cialisation Civil Engineering: Compulsor cialisation Energy and Enviromental Eng cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc	ulsory lsory pulsory pry pry pulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems Ei	npulsory mpulsory ngineering: Compulso
	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation O General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	ivil- and Enviromental Engeneering: Cor lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compu cialisation Process Engineering: Compu cialisation Biomedical Engineering: Compulsor cialisation Naval Architecture: Compulsor cialisation Computer Science: Compulso cialisation Bioprocess Engineering: Com cialisation Civil Engineering: Compulsor cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc	ulsory lsory pulsory pry pry pulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems Ei g, Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Scienc



	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
	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 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 Energy and Enviromental 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
ł	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
ł	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
ł	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 Enviromental 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: Core qualification: Compulsory
	Mechanical Engineering: Core qualification: Compulsory
	Mechatronics: Core qualification: Compulsory
	Naval Architecture: Core qualification: Compulsory
ł	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	rof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgan	
	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 Entrepreneu	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 M0580: Principles of	of Building Materials and Building Physics			
Courses				
Title		Тур	Hrs/wk	CP
Building Physics (L0217)		Lecture	2	2
Building Physics (L0219)		Recitation Section (large)	1	1
Building Physics (L0247)		Recitation Section (small)	1	1
Principles of Building Materials (L0215)		Lecture	2	2
Module Responsible	Prof. Frank Schmidt-Döhl			
Admission Requirements	None			
Recommended Previous	Knowledge of physics, chemistry and mathematics from scho	loc		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following part successfully.	owing learning results		
Professional Competence				
Knowledge Skills	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			
Personal Competence	energy saving, fire protection and noise protection in the cas			
Social Competence	The students are able to support each other to learn the very	extensive specialist knowledge.		
Autonomy	The students are able to make the timing and the operation s	steps to learn the specialist knowledge of a ve	ry extensive field.	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	2 stündige Klausur			
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	r): Specialisation Civil Engineering: Compulso	ory	
	Civil- and Environmental Engineering: Core qualification: Co	ompulsory		
	General Engineering Science (English program): Specialisa	tion Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulso	ry	
	Technomathematics: 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	
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 L0247: Building Physics	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	g 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 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			
	Banang materiale and Banang enemiery			
	 Principles of Building Materials and Building Pl 	iysics		
Educational Objectives	After taking part successfully, students have reached th	ne 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 appropi	ately with respect to its properties and usage.		
	They can use the security concept with respect to load	a forece and resistances		
	They can use the security concept with respect to load	s, loices and resistances.		
	They can check the ultimate limit state and the services	ability of simple members in tension, compression a	nd bending.	
Personal Competence				
Social Competence	After participation of an optional course (building of a	cimple truce) they are able to organize themselve	s in groups. They will	he successful in suided
Social Competence			is in groups. They will	be successiul in guided
A	building a truss with bolted connections according to d	esign urawnigs.		
Autonomy Warkland in Usura		<u></u>		
Workload in Hours Credit points	Independent Study Time 124, Study Time in Lecture 50	2		
Examination	Written exam			
Examination duration and scale	120 minutes			
	General Engineering Science (German program): Spe	eiglication Civil and Environmental Engangering: Co	mpulson	
Assignment for the Following Curricula				
Curricula	General Engineering Science (German program, 7 ser		лу	
	Civil- and Environmental Engineering: Core qualification		maulaan	
	General Engineering Science (English program): Spec			
	General Engineering Science (English program, 7 sen	iester): Specialisation Civil Engineering: Compulso	ry	

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	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	



odule M0631: Concrete S				
ourses				
tle		Тур	Hrs/wk	CP
roject Concrete Structures II (L0894)		Project Seminar	1	1
Concrete Structures II (L0348)		Lecture	3	4
oncrete 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 	ofactions		
	Basics of safety format are required.			
	 Knowledge in design of beams and columns for ultit 	nate limit state		
	Lecture 'Concrete Structures I'			
Educational Objectives	After taking part successfully, students have reached the fol	lowing learning results		
Professional Competence				
Knowledge	The students know the basic principles which arev required for design of reinforced concrete structures. They know the various methods to estimate			
	member forces in simple one and two-way slabs.			
Skills	. The students can desire usinformed concursts structu	en in den uldimente lingit state (skange kangding te		e e e la ilita a lineita eterte (
	The students can design reinforced concrete structu		rsion) and in the servi	ceability limit state (
	and deflection control) including detailing (anchorag	· · · · · · · · · · · · · · · · · · ·		
	The students can estimate the member forces of sim	•		
	 The students know the content and the layout of a st 	ructural analysis		
Personal Competence				
Social Competence	Cooperation in a project work, where they design in a team	a real concrete building and present the result	s 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): Specialis	ation Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semeste			
	Civil- and Environmental Engineering: Core qualification: C			
	General Engineering Science (English program): Specialis		mpulsory	
	General Engineering Science (English program, 7 semeste			

Course L0894: Project Concrete Str	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 fü 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 fü 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	Cycle WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0755: Geotechnic				
	-5 II			
Courses				
Title		Тур	Hrs/wk	CP
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	Machanica I II			
	Mechanics I-II Geotechnics I			
	After taking part successfully, students have reached the	e following 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 foundation 	S.		
	 know individual methods of ground improvement 			
	design retaining walls.	······		
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): Spec	ialisation Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 sem	ester): Specialisation Civil Engineering: Elective C	ompulsory	
	Civil- and Environmental Engineering: Core qualificatio	n: Compulsory		
	General Engineering Science (English program): Speci	alisation Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (English program, 7 sem	ester): Specialisation Civil Engineering: Elective Co	ompulsory	

Course L0552: Foundation Engineer	Course L0552: Foundation Engineering	
Тур	cture	
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	 Shallow foundations Pile foundations Ground improvement Retaining 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 M0728: Hydraulic E	Engineering I			
Courses				
Title		Тур	Hrs/wk	CP
Hydrology (L0909)		Lecture	1	1
Hydrology (L0956)		Problem-based Learning	1	2
Hydromechanics (L0615) Hydromechanics (L0616)		Lecture Recitation Section (large)	2	2
		necitation Section (large)	I	I
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	none			
Recommended Previous	Mathematics I, II and III			
Knowledge	Mechanik I und II			
Educational Objectives	After taking part successfully, students have reached th	e following learning results		
Professional Competence				
Knowledge	The students are able to define the basic terms of hydro	omechanics and hydrology and water management	. They are able to deri	ve the basic formulations
	of i) hydrostatics, ii) kinematics of flows and iii) conserved	rvation laws and to describe and quantify the relev	ant processes of the	hydrological water cycle
	Besides, the students can describe the main aspects o	f rainfall-run-off-modelling and of established reserv	voir / storage models a	as well as the concepts o
	the determination of a unit-hydrograph.			
Skills	The students are able to apply the fundamental formu			
	hydrological approaches and methods to simple hydro	ological 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 c	lescribed and the stud	lents are able to perform
	analyze and assess respective measurements.	,		
Describer				
Personal Competence				
Social Competence	The students are able to prepare and present technica	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	Written exam			
Examination duration and scale	The duration of the examination is 2 hours. The examination	mination includes tasks with respect to the gener	al understanding of	the lecture contents an
	calculations tasks.			
Assignment for the Following	General Engineering Science (German program): Spec			
Curricula	General Engineering Science (German program, 7 sen		ry	
	Civil- and Environmental Engineering: Core qualification			
	General Engineering Science (English program): Spec			
	General Engineering Science (English program, 7 sem	ester): Specialisation Civil Engineering: Compulsor	У	

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
	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
CP	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
	 Characteristics of fluids Hydrostatics Kinematics of flows, laminar and turbulent flows Conservation laws Conservation of mass Conservation of Energy Momentum Equation Application of conservation laws to flow conditions
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



Module M0869: Hydraulic E	ingineering II			
Courses				
Title		Тур	Hrs/wk	CP
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 following 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 of basic hydrodynam		on of basic hydrodynami	
	formulations (conservation laws) to practical hydra	aulic engineering problems. Besides this, the stude	nts can illustrate imp	oortant tasks of hydrauli
	engineering and give an overview over river engine	ering, flood protection, hydraulic power engineering a	nd waterways engine	ering.
Skills	The students are able to apply hydraulic engineerin	g methods and approaches to basic practical problem	is and design respect	ive hydraulic engineerin
	systems. Besides this, they are able to use and appl	y established approaches of hydraulics and determine	e water surfaces of ch	annel flows, influences of
	constructions (weirs, etc.) on channel flows as well a	as flow conditions of pipe system.		
Personal Competence				
Social Competence	The students are able to deploy their gained know	vledge in applied problems. Additionaly, they will be	able to work in tear	n with engineers of othe
	disciplines.			
Autonomy	The students will be able to independently extend the	eir knowledge 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 e	examination includes tasks with respect to the gene	ral understanding of	the lecture contents an
	calculations tasks.			
Assignment for the Following	General Engineering Science (German program): S	pecialisation Civil- and Enviromental Engeneering: Co	ompulsory	
Curricula	General Engineering Science (German program, 7 s	semester): Specialisation Civil Engineering: Elective C	ompulsory	
	Civil- and Environmental Engineering: Core qualific	ation: Compulsory		
	General Engineering Science (English program): Sp	pecialisation Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (English program, 7 s	emester): Specialisation Civil Engineering: Elective C	ompulsory	

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
Content	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	
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



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
	Plote protection o 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
	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



Module M0686: Sanitary Er	igineering			
Courses				
Title		Тур	Hrs/wk	CP
Wastewater Disposal (L0276)		Lecture	2	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				
Knowledge	 Basic knowledge on Chemistry and Biology 			
	 Hydraulics of pipe systems and open channels 			
	 Basic knowledge on water management: water q 	uantity and water quality		
	 Basic knowledge on Environmental Legislation: F 	Federal Water Act		
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	The students can examplify their expert knowledge on u	rhan water infrastructures. They can present the de	rivation and detailor	explanation of import
Kilowieuge				
	standards for the design of drinking water supply and			
	empiricals assumptions and scientific simplifcations. The			-
	used for drinking and wastewater treatment. They can a	• •		
	saftey aspects. Furthermore, they know how to draft th	e features and effectiveness of important technologies	ologies of the future	such as high- and lo
	pressure membrane filtration systems and techniques for	r the removal of trace pollutants.		
Skills	The students are able to apply the relevant standards a expertise comprises expert skills to design drinking wate acquirement of technical skills the students are able to a The students are also able to develop ideas of their own	er supply and urban drainage systems as well as t ddress and solve biochemical problems in the file	he associated treatm d of drinking water a	nent facilities. Besides t and wastewater treatme
Personal Competence Social Competence	Students are able to form concepts on their own to opti when being given some clues or information with regard			
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): Specia			
Curricula	General Engineering Science (German program, 7 seme		mpulsory	
	Civil- and Environmental Engineering: Core qualification	: Compulsory		
	General Engineering Science (English program): Specia	lisation Civil- and Enviromental Engeneering: Con	npulsory	
	General Engineering Science (English program, 7 seme	ster): Specialisation Civil Engineering: Elective Co	mpulsorv	



e L0276: Wastewater Disposal	
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	Die hier aufgeführte Literatur ist in der Bibliothek der TUHH verfügbar.
	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: Oldenborndustrieverl. 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. Ar 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 Supply		
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
CP	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

Specialization Energy and Enviromental Engineering

Forms of energy are used in a variety of ways in industry, domestic households and transportation, so energy is now as important a part of our daily lives as water. Increasingly, attention is paid to sustainable use of energy, without imposing long-term strains on coming generations. Cross-linked training in the foundations of and current issues around energy technology takes account of this situation. One increasingly important concern is to reduce CO_2 emissions responsible for the greenhouse effect. In pursuit of this, energy-saving opportunities are pursued and increasing use is made of regenerative energies. Though fossil fuels will still have to be used for a long time to come, efforts are made to reduce CO_2 emissions by increasing efficiency and by capturing the CO_2 their use generates and storing it underground. These processes in particular make it essential for energy engineering and environmental engineering activities to be closely linked.

Module M0598: 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
Feam Project Design Methodology (L0267)	Problem-based Learning	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous				
Knowledge	Fundamentals of Mechanical Engineering Design			
	Mechanics			
	 Fundamentals of Materials Science 			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the follo	owing learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	explain design guidelines for machinery parts e.g. co	insidering load situation, materials and manu	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 a 	nd documentations e.g. using 3D CAD		
	 design components based on design guidelines auto 			
	 dissign components based on design guidelines add dimension (calculate) used components, 	Shomously,		
	 use methods to design and solve engineering design 	tacks systematically and solution oriented		
		riasks 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 making and documenting decisions, moderate the use of scientific methods, 			
	 present and discuss solutions and technical drawing 			
	 reflect the own results in the work groups of the cours 	Se.		
Autonomy	Students are able			
	 to estimate their level of knowledge using activating 	methods within the lectures (e.g. with clickers	5),	
	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	ation Energy and Enviromental Engineering: (Compulsory	
Curricula	General Engineering Science (German program): Specialisa	ation Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program, 7 semester	r): Specialisation Mechanical Engineering: Co	mpulsory	
	General Engineering Science (German program, 7 semester			
	General Engineering Science (German program, 7 semester			Ŷ
	Energy and Environmental Engineering: Core qualification:			-
	General Engineering Science (English program): Specialisa		ompulsorv	
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory			
		0 0 1 ,	mpulsory	
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	j. Specialisation Energy and Enviromental En	gineening: Compuisor	у
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			



Course L0268: Embodiment Design	and 3D-CAD
	Lecture
Hrs/wk	
	2
CP	
Workload in Hours	
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			
Workload in Hours	pendent 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 R	Project II
-	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.

ourse L0267: Team Project Desigr	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



Courses						
Title		Тур	Hrs/wk	CP		
ntroduction to Energy and Environmental Engineering (L0212)		Problem-based Learning	4	3		
Physics-Lab for VT/ BVT/ EUT (L0947)		Laboratory Course	2	3		
Module Responsible	Prof. Alfons Kather					
Admission Requirements	None					
Recommended Previous	None					
Knowledge						
Educational Objectives	After taking part successfully, students have reached the foll	owing learning results				
Professional Competence						
Knowledge	The students can sketch the different options for electricity a	and heat generation and gain insight into env	vironmental engineerir	ng technology. On a ba		
	level they are able to present and discuss the technical	and environmental engineering advantage	es and disadvantages	(balancing act betwe		
	affordable energy usage and minimization of environme		•	dimension of their futu		
	responsibility and know about the necessity to find compron	nises between energy usage and environmer	nt protection.			
	Through a practical course in physics the students learn to c	leliver an overview of specialist aspects of ph	ysics.			
Skills						
	sources, students are able to work scientifically to critically discuss them on a basic level.					
The students are able to communicate their deepened physics knowledge in ways of written technical commun				nication.		
Personal Competence						
Social Competence						
	students learn communication.					
	The practical course in Physics is also carried out in groups, including the preparation of the test reports. The students strengthen further their soc					
	skills, can achieve in group common results and report them in joint protocols.					
Autonomy	In the seminar the students learn individually to formulate co	onclusions realistically representing the praxi	is. The students are a	ble to work independer		
	on specific technical subjects and to present these to the group.					
	The shadeste are ship to familiaring the second as with surrouting			even e vice e e tel ven e et		
	The students are able to familiarize themselves with experin	iental demonstrations and individually prepa	re and present a short	experimental report.		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84					
Credit points	6					
Examination	Presentation					
Examination duration and scale	EEUT: Compulsory attendance and seminar incl. discussion	on; Physics Lab: error calculation seminar;	6 Experiments with: in	trod. seminar (20 min)		
	handwritten pages preparatory script, transcript on their own	and attestation; 10min short talk; 1 p. hando	ut			
Assignment for the Following	General Engineering Science (German program): Specialis	ation Energy and Enviromental Engineering:	Compulsory			
Curricula	Energy and Environmental Engineering: Core qualification: Compulsory					
	General Engineering Science (English program): Specialisa	tion Energy and Enviromental Engineering: (Compulsory			

Course L0212: Introduction to Energy	gy and Environmental Engineering
Тур	Problem-based Learning
Hrs/wk	4
CP	3
Workload in Hours	Independent Study Time 34, Study Time in Lecture 56
Lecturer	Prof. Alfons Kather
Language	DE
Cycle	WiSe
Content	The course is made up of three components: Lectures by invited speakers, excursions and talks by the students. The lectures by invited speakers are connected to the companys where the excursions take place. From the results of the excursions the students prepare their talks under supervision from faculty staff. The talks are presented to the group and discussed. Some sample topics are: Conventional steam power plants and combined cycle power plants Power plant components (boiler, steam turbine, condenser, feed water heaters, etc.) Distributed electricity generation and energy supply District and neighbourhood heating networks Renewable energy Energy storage Electric grids Energy management at end-user level Energy-intensive industries Environmental technology (e.g., wastewater treatment plants)
Literature	Keine erforderlich



Course L0947: Physics-Lab for VT/	BVT/ EUT
Тур	Laboratory Course
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Wolfgang Hansen
Language	DE/EN
Cycle	WiSe
	In the physics lab a number of key experiments on physical phenomena in mechanics, oscillatory and wave motion, thermodynamics, electricity, and optics will be conducted by the students under assistance of a lecturing tutor. The experiments are part of the physics education program presented in the course "Physics for TUHH-VT Engineers". Beyond teaching of fundamental physical background the objectives are basic skills in preparation and performing physical measurements, usage of physical equipment, analysis of the results and preparation of a report on the experimental data. The students receive instructions in terms of scientific writing as well as feedback on their own reports and level of scientific writing. Before every experiment an colloquium takes place in which the students explain and discuss the theoretical background and its translation into practice with the corresponding experiment.
Literature	Zu den Versuchen gibt es individuelle Versuchsanleitungen, die vor der Versuchsdurchführung ausgegeben werden. Zum Teil müssen die zur Versuchsdurchführung notwendigen physikalischen Hintergründe selbstständig erarbeitet werden, wozu die zur Vorlesung "Physik für TUHH-VT Ingenieure" angegebene Literatur gut geeignet ist.



Module M0536: Fundamen	tals of Fluid Mechanics				
Co					
Courses		Tup	Hrs/wk	CP	
Fundamentals of Fluid Mechanics (L0091		Typ Lecture	2	4	
Fluid Mechanics for Process Engineering		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				
	Simplification and solving of partial differential equations				
	Integration				
Educational Objectives	After taking part successfully, students have reached the followin	g learning results			
Professional Competence					
Knowledge	Students are able to:				
Ũ					
	explain the difference between different types of flow				
	give an overview for different applications of the Reynold				
	 explain simplifications of the Continuity- and Navier-Stoke 	s-Equation by using physical boundary of	conditions		
Skills	The students are able to				
	 describe and model incompressible flows mathematically 				
	 reduce the governing equations of fluid mechanics by sin 		ons e.g. by integration		
	notice the dependency between theory and technical app				
	 use the learned basics for fluid dynamical applications in 	fields of process engineering			
Personal Competence					
Social Competence					
				of the other states and	
	are capable to gather information from subject related, pr				
	 able to work together on subject related tasks in small gro exercises) 	ups. They are able to present their resul	is ellectively in English	(e.g. during small gr	
	 are able to work out solutions for exercises by themselves 	to discuss the solutions orally and to pr	esent 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 their 				
	- wont on and excloses by and own and to evaluate and				
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	Process Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisation	Bioprocess Engineering: Compulsory			
	General Engineering Science (German program): 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 Bioprocess Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory				
	Bioprocess Engineering: Core qualification: Compulsory				
	Energy and Environmental Engineering: Core qualification: Com	,			
General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory					
	General Engineering Science (English program): Specialisation		ompulsory		
	General Engineering Science (English program): Specialisation				
	General Engineering Science (English program, 7 semester): Sp				
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Sp		gineering: Compulsory		
	Technomathematics: Specialisation III. Engineering Science: Ele	ctive 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. 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	1. 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.
	 Duist, L. Shohangshiechanik. Emanling in die meete der Shohangen von Hulden. Springer-verlag, Benin, Heidelberg, 2000. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994
	 Hox, H.W., et al., Introduction to Find Mechanics. J. Wiley & 3018, 1994 Herwig, H.: Strömungsmechanik: Eine Einführung in die Physik und die mathematische Modellierung von Strömungen. Springer Verlag, Berl
	Heidelberg, New York, 2006
	5. Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage Gmb
	Wiesbaden, 2008
	6. Kuhlmann, H.C.: Strömungsmechanik. München, Pearson Studium, 2007
	 Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GV Fachverlage GmbH, Wiesbaden, 2009
	8. Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007
	9. Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berl Heidelberg, 2008
	10. Schlichting, H. : Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006
	11. van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882.
	12. White, F.: Fluid Mechanics, Mcgraw-Hill, ISBN-10:0071311211, ISBN-13:978-0071311212, 2011

Τνρ	Recitation Section (large)
Hrs/wk	
CP	
Workload in Hours	
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				
Courses					
Title		Тур	Hrs/wk	CP	
Electrical Machines (L0293)		Lecture	3	4	
Electrical Machines (L0294)		Recitation Section (large)	2	2	
Module Responsible	Prof. Günter Ackermann				
Admission Requirements	none				
Recommended Previous	Basics of mathematics, in particular complexe numbers, integrals,	differentials			
Knowledge	Basics of electrical engineering and mechanical engineering				
	basics of electrical engineering and mechanical engineering				
Educational Objectives	After taking part successfully, students have reached the following	learning results			
Professional Competence					
Knowledge	Students can to draw and explain the basic principles of electric a	nd magnetic fields.			
	They are describe the function of the standard turns of closed		dina any ations and a	havaatasiatia awaxaa Fa	
	They can describe the function of the standard types of electri- typically used drives they can explain the major parameters of the		÷ ,		
	typically used drives they can explain the major parameters of the	energy eniciency of the whole system in	oni the power grid to th	le unven engine.	
Skills	Students arw able to calculate two-dimensional electric and mage	netic fields in particular ferromagnetic ci	rcuits with air gap. For	this they apply the usua	
	methods of the design auf electric machines.				
	They can calulate the operational performance of electric machines from their given characteristic data and selected quantities 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 magi	natic fields for applications. They are a	able to analyse indep	endently the operationa	
	performance of electric machines from the charactersitic data and				
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 I	nergy and Enviromental Engineering.	Compulsory		
Curricula	General Engineering Science (German program): Specialisation I				
ou.nouu	General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Spo			,	
	Electrical Engineering: Core qualification: Elective Compulsory				
	Energy and Environmental Engineering: Core qualification: Comp	ulsory			
	General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Mechanical Engineering: Elective Compulsory				
	General Engineering Science (English program, 7 semester): Spe	cialisation Energy and Enviromental En	gineering: Compulsory	/	
	General Engineering Science (English program, 7 semester): Spe	cialisation Mechanical Engineering: Ele	ective Compulsory		
	Computational Science and Engineering: Specialisation Engineer	ing Sciences: Elective Compulsory			
	Logistics and Mobility: Specialisation Engineering Science: Election	ve 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	Prof. Günter Ackermann
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			
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Günter Ackermann		
Language	DE		
Cycle	oSe		
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: 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 reache	ed the following learning results		
Professional Competence				
Knowledge	With completion of this module, the students can	n provide an overview of characteristics of energy sy	stems and their econo	omic efficiency. They ca
-	explain the issues occurring in this context. Furthe	ermore, they can explain details of power generation,	power distribution and	power trading wih regar
	to subject-related contexts. The students can expla	ain these aspects, which are applicable to many ener	rav svstems in general.	especially for renewabl
		nore, the students can explain the environmental bene		
		·····		
Personal Competence	Students are able to apply methodologies for detailed determination of energy demand or energy production for various types of energy system Furthermore, they can evaluate energy systems technically, environmentally and economically and design them under certain given condition Therefore, they can choose the necessary subject-specific calculation rules, also for not standardized solutions of a problem. The students are able to explain questions and possible approaches to its processing from the field of renewable energies orally and to put them the into the right context.			
Social Competence				
	sustainability aspects. This allows them to make an	n effective contribuition to a more sustainable power s	upply.	
Autonomy	Students can independently exploit sources, acquire the particular knowledge about the subject area and transform it to new questions.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture	9 84		
Credit points	6			
Examination	Written exam			
Examination duration and scale	3 hours written exam			
Assignment for the Following	General Engineering Science (German program):	Specialisation Energy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program, 7	7 semester): Specialisation Energy and Environmental E	Engineering: Compulso	ry
		/ semester): Specialisation Mechanical Engineering, F		
	Energy and Environmental Engineering: Core qua			
	•••••••	Specialisation Energy and Enviromental Engineering:	Compulson	
		semester): Specialisation Energy and Enviromental E		•
	General Engineering Science (English program, 7	semester): Specialisation Mechanical Engineering, Fe	ocus Enerav Svstems: I	-lective Compulsory

Course L0316: Power Industry	
Тур	Lecture
Hrs/wk	1
CP	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 electricity generation for 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	I Energy Industry		
Тур	Lecture		
Hrs/wk			
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	Lecture			
Hrs/wk	2			
CP				
Workload in Hours	dependent 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 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



Courses				
Title		Тур	Hrs/wk	CP
ntroduction to Management (L0880) Project Entrepreneurship (L0882)		Lecture Problem-based Learning	3 2	3 3
Module Responsible	Prof. Christoph Ihl			-
Admission Requirements				
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students have reached th	e following learning results		
Professional Competence				
Knowledge	After taking this module, students know the important I Marketing and Innovation, and also to Investment and 0		nagement, from Planr	ning and Organisation
	 explain the differences between Economics and field of Management 	Management and the sub-disciplines in Management	ent and to name impo	ortant definitions from t
	-	in Management and name the most important aspe	cts of entreprneurial p	projects
	describe and explain basic business functions	as production, procurement and sourcing, supply	chain management, o	organization and hum
	ressource management, information manageme	ent, innovation management and marketing		
		n making in Business, esp. in situations under mu	Itiple objectives and	uncertainty, and expla
	some basic methods from mathematical Finance			
	 state basics from accounting and costing and see 	lected controlling methods.		
Skills	Students are able to analyse business units with Entrepreneurship project in a team. In particular, they a		tives, strategies etc.	.) and to carry out
	analyse Management goals and structure them	appropriately		
	 analyse organisational and staff structures of co 			
	 apply methods for decision making under multiple 			
	analyse production and procurement systems a			
	analyse and apply basic methods of marketing			
	select and apply basic methods from mathemati	cal finance to predefined problems		
	apply basic methods from accounting, costing a	nd controlling to predefined problems		
Personal Competence				
Social Competence	Students are able to			
	 work successfully in a team of students 			
	•	ntrepreneurship project and write a coherent report	on the project	
	 to communicate appropriately and 			
	 to cooperate respectfully with their fellow studer 	ts.		
Autonomy	Students are able to			
	 work in a team and to organize the team themse 	lves		
	 to write a report on their project. 			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points				
	Written exam			
Examination				
Examination Examination duration and scale	90 Minuten			
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec			
Examination duration and scale	General Engineering Science (German program): Spec General Engineering Science (German program): Spec	ialisation Computer Science: Compulsory		
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory		
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory		
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program): Spec	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Co	1	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program): Spec	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Co ialisation Civil- and Enviromental Engeneering: Cor	1	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program): Spec	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Co ialisation Civil- and Enviromental Engeneering: Cor ialisation Mechanical Engineering: Compulsory	1	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program): Spec	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Co ialisation Civil- and Enviromental Engeneering: Cor ialisation Mechanical Engineering: Compulsory ialisation Biomedical Engineering: Compulsory	1	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program): Spec	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Co- ialisation Civil- and Enviromental Engeneering: Co- ialisation Mechanical Engineering: Compulsory ialisation Biomedical Engineering: Compulsory ialisation Naval Architecture: Compulsory	npulsory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program): Spec	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Co- ialisation Civil- and Enviromental Engeneering: Co- ialisation Mechanical Engineering: Compulsory ialisation Biomedical Engineering: Compulsory ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp	ulsory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program): Spec	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Co- ialisation Civil- and Enviromental Engeneering: Co- ialisation Mechanical Engineering: Compulsory ialisation Biomedical Engineering: Compulsory ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Compu- seter): Specialisation Process Engineering: Compu-	ulsory Isory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Co ialisation Civil- and Enviromental Engeneering: Cor ialisation Mechanical Engineering: Compulsory ialisation Biomedical Engineering: Compulsory ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Compu ester): Specialisation Process Engineering: Compu ester): Specialisation Biomedical Engineering: Compu ester): Specialisation Biomedical Engineering: Compu	ulsory Isory Ipulsory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Co- ialisation Civil- and Enviromental Engeneering: Cor ialisation Mechanical Engineering: Compulsory ialisation Biomedical Engineering: Compulsory ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Compu- lester): Specialisation Process Engineering: Compu- lester): Specialisation Biomedical Engineering: Compu- lester): Specialisation Biomedical Engineering: Compu- lester): Specialisation Naval Architecture: Compulsor	ulsory Isory Ipulsory Ipulsory Iry	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Co- ialisation Civil- and Enviromental Engineering: Cor- ialisation Mechanical Engineering: Compulsory ialisation Biomedical Engineering: Compulsory ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Compu- lester): Specialisation Process Engineering: Compu- lester): Specialisation Biomedical Engineering: Compu- lester): Specialisation Naval Architecture: Compulsor ester): Specialisation Naval Architecture: Compulsor ester): Specialisation Computer Science: Compulsor	ulsory Isory Ipulsory Ipulsory Iry	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Co- ialisation Civil- and Enviromental Engeneering: Cor- ialisation Mechanical Engineering: Compulsory ialisation Biomedical Engineering: Compulsory ialisation Naval Architecture: Compulsory eester): Specialisation Electrical Engineering: Compu- ester): Specialisation Electrical Engineering: Compu- ester): Specialisation Process Engineering: Compu- ester): Specialisation Naval Architecture: Compulsor ester): Specialisation Naval Architecture: Compulsor ester): Specialisation Computer Science: Compulsor ester): Specialisation Bioprocess Engineering: Com-	ulsory Isory Ipulsory Ipulsory Iry Ipulsory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Cor ialisation Civil- and Enviromental Engeneering: Cor ialisation Mechanical Engineering: Compulsory ialisation Biomedical Engineering: Compulsory ialisation Naval Architecture: Compulsory eester): Specialisation Electrical Engineering: Compu ester): Specialisation Electrical Engineering: Compu ester): Specialisation Process Engineering: Compu ester): Specialisation Naval Architecture: Compulsor ester): Specialisation Naval Architecture: Compulso ester): Specialisation Computer Science: Compulso ester): Specialisation Bioprocess Engineering: Com ester): Specialisation Civil Engineering: Compulsor ester): Specialisation Civil Engineering: Compulsor	npulsory Isory Isory npulsory ny npulsory y jineering: Compulsor	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Cor ialisation Mechanical Engineering: Compulsory ialisation Mechanical Engineering: Compulsory ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Compu- ester): Specialisation Electrical Engineering: Compu- ester): Specialisation Process Engineering: Compu- ester): Specialisation Naval Architecture: Compulsory ester): Specialisation Naval Architecture: Compulsor ester): Specialisation Naval Architecture: Compulsor ester): Specialisation Computer Science: Compulsor ester): Specialisation Bioprocess Engineering: Com- ester): Specialisation Civil Engineering: Com- ester): Specialisation Energy and Enviromental Eng- ester): Specialisation Mechanical Engineering, Foc	npulsory Isory Isory Ipulsory Inpulsory Ipulsory Y jineering: Compulsor us Mechatronics: Cor	npulsory
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Cor ialisation Civil- and Enviromental Engeneering: Cor ialisation Mechanical Engineering: Compulsory ialisation Biomedical Engineering: Compulsory ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Compu ester): Specialisation Electrical Engineering: Compu ester): Specialisation Process Engineering: Compulsory ester): Specialisation Naval Architecture: Compulsor ester): Specialisation Naval Architecture: Compulso ester): Specialisation Computer Science: Compulso ester): Specialisation Electrical Engineering: Com- ester): Specialisation Civil Engineering: Compulsor ester): Specialisation Energy and Enviromental Eng- ester): Specialisation Mechanical Engineering, Foc- ester): Specialisation Mechanical Engineering, Foc-	ulsory Isory Isory Ipulsory Iry Ipulsory y jineering: Compulsor us Mechatronics: Cor us Biomechanics: Co	npulsory mpulsory
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Cor- ialisation Mechanical Engineering: Compulsory ialisation Mechanical Engineering: Compulsory ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Compu- ester): Specialisation Electrical Engineering: Compu- ester): Specialisation Process Engineering: Compu- ester): Specialisation Naval Architecture: Compulsory ester): Specialisation Naval Architecture: Compulsor ester): Specialisation Naval Architecture: Compulsor ester): Specialisation Computer Science: Compulsor ester): Specialisation Computer Science: Compulsor ester): Specialisation Energy and Enviromental Eng- ester): Specialisation Mechanical Engineering, Foc- ester): Specialisation Mechanical Engineering, Foc- ester): Specialisation Mechanical Engineering, Foc-	ulsory Isory Isory Ipulsory Inpulsory Inpulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems Ei	npulsory mpulsory ngineering: Compulso
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Cor- ialisation Mechanical Engineering: Compulsory ialisation Mechanical Engineering: Compulsory ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Compu- ester): Specialisation Electrical Engineering: Compu- ester): Specialisation Process Engineering: Compu- ester): Specialisation Naval Architecture: Compulsory ester): Specialisation Naval Architecture: Compulsor ester): Specialisation Naval Architecture: Compulsor ester): Specialisation Computer Science: Compulsor ester): Specialisation Computer Science: Compulsor ester): Specialisation Energy and Enviromental Eng- ester): Specialisation Mechanical Engineering, Foc- ester): Specialisation Mechanical Engineering, Foc- ester): Specialisation Mechanical Engineering, Foc-	ulsory Isory Isory Ipulsory Inpulsory Inpulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems Ei	npulsory mpulsory ngineering: Compulso
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Spec General Engineering Science (German program, 7 sen General Engineering Science (German program, 7 sen	ialisation Computer Science: Compulsory ialisation Process Engineering: Compulsory ialisation Bioprocess Engineering: Compulsory ialisation Energy and Enviromental Engineering: Cor- ialisation Mechanical Engineering: Compulsory ialisation Mechanical Engineering: Compulsory ialisation Naval Architecture: Compulsory ialisation Naval Architecture: Compulsory eester): Specialisation Electrical Engineering: Compu- eester): Specialisation Process Engineering: Compu- eester): Specialisation Naval Architecture: Compulsor eester): Specialisation Naval Architecture: Compulsor eester): Specialisation Naval Architecture: Compulsor eester): Specialisation Computer Science: Compulsor eester): Specialisation Computer Science: Compulsor eester): Specialisation Energy and Enviromental Engi eester): Specialisation Mechanical Engineering, Foc eester): Specialisation Mechanical Engineering, Foc eester): Specialisation Mechanical Engineering, Foc eester): Specialisation Mechanical Engineering, Foc eester): Specialisation Mechanical Engineering, Foc	ulsory lsory pulsory pry pry pulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems Ei I, Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Scienc



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
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 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 Energy and Enviromental 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 Enviromental 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: 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		
	rsten, Prof. Matthias Meyer, Prof. Thomas Wrona		
Language	DE		
Cycle	WiSe/SoSe		
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 Mana 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	ourse L0882: Project Entrepreneurship		
Тур	lem-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 M0956: Measureme	ent Technology for Mechanical and Proc	ess Fngineers			
Module M0350. Measurenie	and rectinology for mechanical and Proc				
Courses					
ītle		Тур	Hrs/wk	CP	
Practical Course: Measurement and Contr	rol Systems (L1119)	Laboratory Course	2	2	
Measurement Technology for Mechanical	and Process Engineers (L1116)	Lecture	2	3	
leasurement 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 e	ngineering			
Knowledge					
Educational Objectives	After taking part successfully, students have reached th	ne following learning results			
Professional Competence		• •			
Knowledge	Students are able to name the most important fundme	entals of the Measurement Technology (Quantities	and Units Uncertaint	v Calibration Static	
	Dynamic Properties of Sensors and Systems).			y, ouloratori, olato	
	They can outline the most important measuring metho	ds for different kinds of quantities to be maesured (Electrical Quantities,	Temperature, mechar	
	quantities, Flow, Time, Frequency).				
	The second se		and the A		
	They can describe important methods of chemical Ana	lysis (Gas Sensors, Spectroscopy, Gas Chromatogr	apny)		
Skills	Students can select suitable measuring methods to give	ren problems 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.				
	the right context and application area.				
Personal Competence					
Social Competence	Students can arrive at work results in groups and docu	ment them in a common report.			
Autonomy	Students are able to familiarize themselves with new n	neasurement technologies.			
, atoming		louden of the control			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70	0			
Credit points	6				
Examination	Written exam				
Examination duration and scale	105 minutes				
Assignment for the Following	General Engineering Science (German program): Spe	cialisation Energy and Environmental Engineering: (compulsory		
Curricula	General Engineering Science (German program): Spe		ompaisory		
ourrioud					
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory				
	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 Mechanical Engineering: Compulsory				
	General Engineering Science (German program, 7 ser				
	General Engineering Science (German program, 7 ser	, 1 6 6 1	ulsory		
	Energy and Environmental Engineering: Core qualifica				
	General Engineering Science (English program): Spec		ompulsory		
	General Engineering Science (English program): Spec				
	General Engineering Science (English program): Spec				
	General Engineering Science (English program): Spec				
	General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (English program, 7 sen	nester): Specialisation Mechanical Engineering: Co	mpulsory		
	General Engineering Science (English program, 7 sen	nester): Specialisation Biomedical Engineering: Cor	npulsory		
	General Engineering Science (English program, 7 sen	nester): Specialisation Process Engineering: Compu	Ilsory		
	Mechanical Engineering: Core qualification: Compulse	ory			
	Mechatronics: Core qualification: Compulsory				



Course L1119: Practical Course: M	easurement and Control Systems		
Тур	Laboratory Course		
Hrs/wk	2		
CP	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 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			
СР			
Workload in Hours Lecturer	Independent Study Time 62, Study Time in Lecture 28 Dr. Sven Krause		
Language	DE		
Cycle	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.		

Course L1118: Measurement Techn	ourse 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	ental Technology			
Courses				
Title		Тур	Hrs/wk	CP
Practical Exercise Environmental Technol	ology (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 biolog	у		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	With the completion of this modul the students obtain	profound knowledge of environmental technolo	gy. They are able to d	escribe the behaviour
	chemicals in the environment. Students can give an or	verview of scientific disciplines involved. They	can explain terms and	allocate them to relate
	methods.			
01.71		and a Weather the second s		
Skills	Ills Students are able to propose appropriate management and mitigation measures for environmental problems. They are able to determine geoc parameters and to assess the potential of pollutants to migrate and transform. The students are able to work out well founded opinions			-
		•		
	Environmental Technology contributes to sustainable de	velopment, and they can present and delend the	ise opinons in front of a	ind against the group.
Personal Competence				
Social Competence	The students are able to discuss the various technical a	nd scientific tasks, both subject-specific and mu	tidisciplinary. They are	able to develop differe
	approaches to the task as a group as well as to discuss their theoretical or practical implementation.			
A				
Autonomy	Students can independently exploit sources about of the	subject, acquire the particular knowledge and tr	anier it to new problem	5.
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): Specia	alisation Energy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specia	alisation Process Engineering: Elective Compuls	ory	
	General Engineering Science (German program, 7 seme	ester): Specialisation Energy and Enviromental E	ngineering: Compulso	ry
	General Engineering Science (German program, 7 seme	ster): Specialisation Process Engineering: Elect	ive Compulsory	
	General Engineering Science (German program, 7 seme	ester): Specialisation Bioprocess Engineering: El	ective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Cor	npulsory		
	Energy and Environmental Engineering: Core qualification	on: Compulsory		
	General Engineering Science (English program): Specia	lisation Energy and Enviromental Engineering:	Compulsory	
	General Engineering Science (English program): Specia	lisation Process Engineering: Elective Compuls	ory	
	Concercil Experience Colonnee (Experience Annual Toronte	ster): Specialisation Energy and Enviromental E	agineering: Compulsor	
	General Engineering Science (English program, 7 seme	stor). Opeolansation Energy and Environmental E	igineening. oompuisoi	у
	General Engineering Science (English program, 7 seme	, , ,		у
		ster): Specialisation Process Engineering: Electi	ve Compulsory	y

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	
Content	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	Course L0326: Environmental Technologie		
Тур	ture		
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	 Introductory seminar on environmental science: Environmental impact and adverse effects Wastewater technology Air pollution control Noise protection Waste and recycling management Soil and ground water protection Renewable energies Resource conservation and energy efficiency 		
Literature	Förster, U.: Umweltschutztechnik; 2012; Springer Berlin (Verlag) 8., Aufl. 2012; 978-3-642-22972-5 (ISBN)		



Module M0538: Heat and M	ass Transfer			
Courses				
Title	Typ Hrs/wk CP			
Heat and Mass Transfer (L0101)	Lecture 2 2			
Heat and Mass Transfer (L0102) Heat and Mass Transfer (L1868)	Recitation Section (small) 1 2 Recitation Section (large) 1 2			
Module Responsible	Prof. Irina Smirnova			
	None			
Admission Requirements Recommended Previous	Basic knowledge: Technical Thermodynamics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence	· · · · · · · · · · · · · · · · · · ·			
Knowledge				
	• The students are capable of explaining qualitative and determining quantitative heat transfer in procedural apparatus (e. g. heat exchange			
	chemical reactors).			
	They are capable of distinguish and characterize different kinds of heat transfer mechanisms namely heat conduction, heat transfer and then add at a set of the set of			
	radiation.			
	 The students have the ability to explain the physical basis for mass transfer in detail and to describe mass transfer qualitative and quantitative using suitable mass transfer theories. 			
	 They are able to depict the analogy between heat- and mass transfer and to describe complex linked processes in detail. 			
Skills	• The students are able to set reasonable system boundaries for a given transport problem by using the gained knowledge and to balance			
	corresponding energy and mass flow, respectively.			
	They are capable to solve specific heat transfer problems (e.g. heated chemical reactors, temperature alteration in fluids) and to calculate			
	corresponding heat flows.			
	Using dimensionless quantities, the students can execute scaling up of technical processes or apparatus.			
	• They are able to distinguish between diffusion, convective mass transition and mass transfer. They can use this knowledge for the description			
	and design of apparatus (e.g. extraction column, rectification column).			
	In this context, the students are capable to choose and design fundamental types of heat and mass exchanger for a specific application			
	considering their advantages and disadvantages, respectively.			
	In addition, they can calculate both, steady-state and non-steady-state processes in procedural apparatus.			
	• The students are capable to connect their knowledge obtained in this course with knowlegde of other courses (In particular the cour			
	thermodynamics, fluid mechanics and chemical process engineering) to solve concrete technical problems.			
Personal Competence				
Social Competence				
	• The students are capable to work on subject-specific challenges in teams and to present the results orally in a reasonable manner to tutors and			
	other students.			
Autonomy	The students are able to find and evaluate necessary information from suitable sources			
	 They are able to prove their level of knowledge during the course with accompanying procedure continuously (clicker-system, exam- 			
	assignments) and on this basis they can control their learning processes.			
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): Specialisation Process Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory			
	General Engineering Science (German program): 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 Bioprocess Engineering: Compulsory			
	General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory			
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory			
	General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory			
	Concerned Engineering Science (English program): Specialization Dresses Engineering: Comercialization			
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory			
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: 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 Process Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory			
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory			



Course L0101: Heat and Mass Trans	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	 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 Tran	ourse 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	

Course L1868: Heat and Mass Trans	Course 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	paration Processes			
Courses				
Title		Тур	Hrs/wk	CP
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				
Kilowiedge				
Educational Objectives	After taking part successfully, students have reached the fo	llowing learning results		
Professional Competence				
Knowledge				
interneuge	 The students can distinguish and describe different 	types of separation processes such as distillation	on, extraction, and ad	sorption
	• The students develop an understanding for the co	urse of concentration during a separation proc	ess. the estimation o	f the energy demand c
	process, the possibilities of energy saving, and the		,	3,
	 They have good knowledge of designing methods f 	or separation processes and devices		
Skills				
	 Using the gained knowledge the students can select the students c	ct a reasonable system boundary for a given se	paration process and	can close the associa
	energy and material balances			
	 The students can use different graphical methods for 	or the designing of a separation process and de	fine the amount of the	oretical stages require
	 They can select and design a basic type of therm 	al separation process for a given case based	on the advantages a	and disadvantages of
			on the advantages t	and disadvantages of
	process			
	 The students are capable to obtain independently the students are capable to obtain independently the students are capable. 	ne needed material properties from appropriate	sources (diagrams a	nd tables)
	 They can calculate continuous and discontinuous p 	rocesses		
	 The students are able to prove their theoretical know 	wledge in the experimental lab work.		
	 The students are able to discuss the theoretical bac 	kground and the content of the experimental wo	ork with the teachers i	n colloguium.
	The students are capable of linking their gained knowledge	e with the content of other lectures and use it t	ogether for the soluti	on of technical probler
	Other lectures such as thermodynamics, fluid mechanics and	nd chemical engineering.		
Personal Competence				
Personal Competence				
Social Competence	• The students can work technical assignments in sm	all arouns and present the combined results in	the tutorial	
		an groups and present the combined results in		
	 The students are able to carry out practical lab work 	k in small groups and organize a functional div	vision of labor betwee	en them. They are able
	discuss their results and to document them scientific	cally in a report.		
Autonomy	-			
	 The students are capable to obtain the needed info 	•		
	 The students can proof the state of their knowledge 	with exam resembling assignments and in this	way control their lear	ning 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): Specialis	sation Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialis	sation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Speciali	sation Energy and Enviromental Engineering: C	ompulsory	
	General Engineering Science (German program, 7 semest			
	General Engineering Science (German program, 7 semest	, , , , , ,		
	General Engineering Science (German program, 7 semest	er): Specialisation Energy and Enviromental En	gineering: Compulso	ry
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification	: Compulsory		
	General Engineering Science (English program): Specialis			
	General Engineering Science (English program): Specialis	ation Energy and Enviromental Engineering: Co	ompulsory	
	General Engineering Science (English program): Specialis	ation Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semeste		lsory	
	General Engineering Science (English program, 7 semeste		-	
	Sonoral Engineering Science (English program, 7 semeste			
	General Engineering Science (English program, 7 semester Process Engineering: Core qualification: Compulsory	er): Specialisation Energy and Enviromental Eng	gineering: Compulso	У



Тур	Lecture		
CP	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. 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 		



Course L0119: Thermal Separation	
	Recitation Section (small)
Hrs/wk	
CP	
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	 The students work on tasks in small groups and present their results in front of all students. 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 Ullmanr Enzyklopädie der Technischen Chemie



Тур	Recitation Section (large)
Hrs/wk	
CP	1
	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 Selection 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. 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



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 devices without discrete stages Dirying Chromatographic separation processes Membrane separation
Literature	 Energy demand of separation processes Advance overview of separation processes Selection of separation processes
	 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. Steinkopfl Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verfag, 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 M0639: Gas and St	eam Power Plants			
Courses				
Title		Тур	Hrs/wk	CP
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" "Heat Transfer" 			
	"Fluid Mechanics"			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The students can evaluate the development of the electricity dem	and and the energy conversion routes	in the thermal power pl	ant, describe the vario
	types of power plant and the layout of the steam generator blo	ck. They are also able to determine th	e operation characteri	stics of the power pla
	Additionally they can describe the exhaust gas cleaning appara	atus and the combination possibilities of	of conventional fossil-fu	uelled power plants w
	solar thermal and geothermal power plants or plants equipped wi	th Carbon Capture and Storage.		
	The students have basic knowledge about the principles, operation	on and design of turbomachinery		
Skille	The students will be able, using theories and methods of the ene	ray technology from fossil fuels and ba	ood on woll founded kr	owledge on the function
Skills	and construction of gas and steam power plants, to identify bas			
	solutions. Through analysis of the problem and exposure to the			
	the capability and methodology to develop realistic optimal conce		0	
	the students become the ability to follow better the deliberations	, ,	•	
	supply and environmental protection).		,	
	Within the framework of the exercise the students learn the use of	f the specialised software suite EBSILC	ON Professional TM . With	n this tool small practio
	tasks are solved with the PC, to highlight aspects of the design and development of power plant cycles.			
	The students are able to do simplified calculations on turbomachi	nery either as part of a plant, as single c	component or at stage le	evel.
Personal Competence				
Social Competence	An excursion within the framework of the lecture is planned for st	udents that are interested. The students	get in this manner dire	ect contact with a mode
	power plant in this region. The students will obtain first-hand ex			
	technical and political issues.			
Autonomy	The students assisted by the tutors will be able to develop alon	e simple simulation models and run wi	ith these scenario anal	yses. In this manner t
	theoretical and practical knowledge from the lecture is consol	idated and the potential effects from	different process com	binations and bounda
	conditions highlighted. The students are able independently to	analyse the operational performance	of steam power plants	and calculate select
	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	General Engineering Science (German program): Specialisation	Energy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Energy	Systems: Compulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Energy and Enviromental E	ngineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering, Fo	ocus Energy Systems: E	Elective Compulsory
	Energy and Environmental Engineering: Core qualification: Comp	pulsory		
	General Engineering Science (English program): Specialisation E	Energy and Enviromental Engineering: C	Compulsory	
	General Engineering Science (English program): Specialisation N	Nechanical Engineering, Focus Energy	Systems: Compulsory	
	General Engineering Science (English program, 7 semester): Spe	ecialisation Energy and Enviromental Er	ngineering: Compulsory	/
	General Engineering Science (English program, 7 semester): Spe	ecialisation Mechanical Engineering, Fo	cus Energy Systems: E	lective Compulsory
	Mechanical Engineering: Specialisation Energy Systems: Compu	lsory		



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
	DE
Language	
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



Course L0210: Gas and Steam Powe	er Plants
Тур	Recitation Section (large)
	2
	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Alfons Kather
- 5- 5-	WiSe
-	
Content	In the 1 st part of the lecture a general introduction into fluid-flow machines 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 the
	lecture hall exercise. The challenges in plant operation from interconnecting conventional power plants and renewable energy sources are discussed
	and the technical options for providing security of supply and network stability are presented, also under consideration of cost effectiveness. In this
	critical review, focus is especially placed on the compatibility of the different solutions with the environment and climate. With this, the awareness for the
	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 tasks are
	solved on the PC, to highlight aspects of the design and development of power plant cycles. The students present their results orally and can afterward
	ask questions and get feedback. The course work has a positive effect on the students final grade.
Literature	
Enterature	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, Technische Verlag Resch / Verlag TÜV Rheinland



Courses				
Fitle		Tup	Hrs/wk	CP
Fundamentals of Materials Science I (L10	85)	Typ 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	·····			
Ũ				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence	3 F	,		
Knowledge	The students have acquired a fundamental knowledge on n	etals, ceramics and polymers an	nd can describe this knowle	edae comprehensi
	Fundamental knowledge here means specifically the issues of a			
	mechanical properties. The students know about the key aspec			
	characterizing specific properties. They are able to trace material	phenomena back to the underlying	g physical and chemical laws	s of nature.
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 r	microstructure, and
	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			
Oue dit meinte	C			
Credit points				
Examination	Written exam			
Examination Examination duration and scale	Written exam 180 min			
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation			
Examination Examination duration and scale	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation	Mechanical Engineering: Compulso	ory	
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation	Mechanical Engineering: Compulso Biomedical Engineering: Compulso	ory	
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory	pry ry	
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory ecialisation Mechanical Engineering	ory ry g: Compulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering	ry g: Compulsory g: Compulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 180 min 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	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con	ry ry g: Compulsory g: Compulsory npulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment	ry ry g: Compulsory g: Compulsory npulsory	,
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Comp	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory	ory ry g: Compulsory g: Compulsory npulsory tal Engineering: Compulsory	,
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation former (Semeral Engineering Science) (Semeral Semeral Semeral Engineering Science) (Semeral Semeral Semera	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering	ory ry g: Compulsory g: Compulsory npulsory tal Engineering: Compulsory ng: Compulsory	, ,
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation f General Engineering Science (English program): Specialisation f General Engineering Science (English program): Specialisation f	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Mechanical Engineering: Compulsor	ory ry g: Compulsory g: Compulsory npulsory tal Engineering: Compulsory ng: Compulsory ry	, ,
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation former (Semeral Engineering Science) (Semeral Specialisation (Semeral Engineering Science) (Semeral Specialisation (Semeral Engineering Science) (Semeral Specialisation (Semeral Specialisation)) (Semeral Specialisation) (Semeralis) (Semeralis) (Semeral Specialis) (S	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Vaval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Mechanical Engineering: Compulsor Biomedical Engineering: Compulsor	ory ry g: Compulsory g: Compulsory npulsory tal Engineering: Compulsory ng: Compulsory ry	, ,
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation f General Engineering Science (English progra	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Vaval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Mechanical Engineering: Compulsory Biomedical Engineering: Compulsory Iaval Architecture: Compulsory	ory ry g: Compulsory g: Compulsory mpulsory tal Engineering: Compulsory ng: Compulsory ry y	, ,
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation f General Engineering Science (English progra	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Vaval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Acchanical Engineering: Compulsors Biomedical Engineering: Compulsory Javal Architecture: Compulsory scialisation Mechanical Engineering	ory ry g: Compulsory g: Compulsory nal Engineering: Compulsory ng: Compulsory ry y g: Compulsory	, ,
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation f General Engineering Science (English progra	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Vaval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Acchanical Engineering: Compulsors Biomedical Engineering: Compulsory Javal Architecture: Compulsory scialisation Mechanical Engineering cialisation Biomedical Engineering	ory ry g: Compulsory g: Compulsory nal Engineering: Compulsory ng: Compulsory ry y g: Compulsory p: Compulsory	, ,
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp 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, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Vaval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Acchanical Engineering: Compulsory Somedical Engineering: Compulsory vialisation Mechanical Engineering ecialisation Biomedical Engineering scialisation Naval Architecture: Com	yry ry g: Compulsory g: Compulsory nal Engineering: Compulsory ng: Compulsory ry y g: Compulsory pulsory ipulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program): Specialisation I General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Vaval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Acchanical Engineering: Compulsory socialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Com socialisation Naval Architecture: Com ecialisation Naval Architecture: Com ecialisation Naval Architecture: Com	yry ry g: Compulsory g: Compulsory nal Engineering: Compulsory ng: Compulsory ry y g: Compulsory pulsory ipulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 180 min 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 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, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp Ge	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Vaval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Acchanical Engineering: Compulsory socialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Com socialisation Naval Architecture: Com ecialisation Naval Architecture: Com ecialisation Naval Architecture: Com	yry ry g: Compulsory g: Compulsory nal Engineering: Compulsory ng: Compulsory ry y g: Compulsory pulsory ipulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 180 min 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 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, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp Ge	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Vaval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Acchanical Engineering: Compulsory socialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Com socialisation Naval Architecture: Com ecialisation Naval Architecture: Com ecialisation Naval Architecture: Com	yry ry g: Compulsory g: Compulsory nal Engineering: Compulsory ng: Compulsory ry y g: Compulsory pulsory ipulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 180 min General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sp 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, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp Cogistics and Mobility: Specialisation Engineering Science: Elect Mechanical Engineering: Core qualification: Compulsory	Mechanical Engineering: Compulso Biomedical Engineering: Compulso Vaval Architecture: Compulsory ecialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Con ecialisation Energy and Enviroment pulsory Energy and Enviromental Engineering Acchanical Engineering: Compulsory socialisation Mechanical Engineering ecialisation Biomedical Engineering ecialisation Naval Architecture: Com socialisation Naval Architecture: Com ecialisation Naval Architecture: Com ecialisation Naval Architecture: Com	yry ry g: Compulsory g: Compulsory nal Engineering: Compulsory ng: Compulsory ry y g: Compulsory pulsory ipulsory	

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 Chemi	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 M0670: Particle Teo	chnology and Solids Process Engineering			
Courses				
Title Particle Technology I (L0434) Particle Technology I (L0435)		Typ Lecture Recitation Section (small)	Hrs/wk 2 1	CP 3
Particle Technology I (L0440)		Laboratory Course	2	2
Module Responsible	Prof. Stefan Heinrich			
Admission Requirements	None			
Recommended Previous Knowledge	keine			
Educational Objectives	After taking part successfully, students have reached the following learn	ing results		
Professional Competence				
Knowledge	After successful completion of the module students are able to			
	 name and explain processes and unit-operations of solids proce characterize particles, particle distributions and to discuss their b 			
Skills	 Students are able to choose and design apparatuses and processes for solids processing according to the desired solids properties of the product asses solids with respect to their behavior in solids processing steps document their work scientifically. 			
Personal Competence Social Competence Autonomy	The students are able to discuss scientific topics orally with other studen a group. Students are able to analyze and solve questions regarding solid partic		elop solutions for tech	inical-scientific issues in
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 Proces	s Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Biopro	cess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Energy			
	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 Energy and Enviromental Eng	ineering: Compulsory	1
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Bioprod General Engineering Science (English program): Specialisation Energy		mpulson	
	General Engineering Science (English program): Specialisation Energy General Engineering Science (English program): Specialisation Proces		mpulsory	
	General Engineering Science (English program, 7 semester): Specialisation Proces		sorv	
	General Engineering Science (English program, 7 semester): Specialisa General Engineering Science (English program, 7 semester): Specialisa	• • •		
	General Engineering Science (English program, 7 semester): Specialisa General Engineering Science (English program, 7 semester): Specialisa			
	Process Engineering: Core qualification: Compulsory			



Course L0434: Particle Technology	
Тур	
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	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	I		
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.		



Module M1274: Environme	ntal Technology				
Courses					
Title		Tun	Hrs/wk	CP	
		Typ	нгз/wк 2	2	
Environmental Assessment (L0860) Environmental Assessment (L1054)		Lecture Recitation Section (small)	2	2	
Module Responsible	Prof. Martin Kaltschmitt	neoidaion occition (smail)			
Admission Requirements	None				
Recommended Previous	Fundamentals of inorganic/organic chemistry and biology				
Knowledge					
Educational Objectives	After taking part successfully, students have reached the following	ng learning results			
Professional Competence					
Knowledge	With the completion of this module the students acquire in-dept	h knowledge of important cause-effect cha	ins of potential enviro	onmental problems whi	
	might occur from production processes, projects or construction	measures. They have knowledge about the	ne methodological div	versity and are compete	
	in dealing with different methods and instruments to assess en	vironmental impacts. Besides the student	s are able to estimat	e the complexity of the	
	environmental processes as well as uncertainties and difficulties with their measurement.				
Skills	The students are able to select a suitable method for the respective case from the variety of assessment methods. Thereby they can develop suit				
	solutions for managing and mitigating environmental problem	ns in a business context. They are able	to carry out Life Cy	cle Impact Assessme	
	independently and can apply the software programs OpenLCA and the database Ecolnvent. After finishing the course the stu				
	to critically judge research results or other publications on enviro	onmental impacts.			
Personal Competence					
Social Competence	The students are able to discuss the various technical and scie				
	different solutions and to discuss their theoretical or practical implementation. Due to the selected lecture topics, the students receive insights into the				
	multi-layered issues of the environment protection and the co			wards these subjects a	
	raised and which helps to raise their awareness of their future so	ocial responsibilities in their role as engine	ers.		
Autonomy	The students learn to research, process and present a scientifi solve an environmental problem in a business context and are a		arry out independent	scientific work. They c	
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): Specialisatior	Energy and Enviromental Engineering: C	ompulsory		
Curricula	General Engineering Science (German program): Specialisation				
ou noua	General Engineering Science (German program), Specialisator General Engineering Science (German program, 7 semester): S			rv	
				· y	
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Elective Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Elective Compulsory				
	Bioprocess Engineering: Core qualification: Elective Compulsor		cive compulsory		
	Energy and Environmental Engineering: Core qualification: Con	•			
			maulaan		
	General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (English program): Specialisation Process Engineering: Elective Compulsory				
	General Engineering Science (English program, 7 semester): Sp			у	
	General Engineering Science (English program, 7 semester): Sp	• •			
	General Engineering Science (English program, 7 semester): Sp	Declansation Bioprocess Engineering: Elec	ave Compuisory		
	Process Engineering: Core qualification: Elective Compulsory				
	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			
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			

z



TUHH

Module M0933: Fundamen	tals of Materials Science				
Courses					
Title		Тур	Hrs/wk	CP	
Fundamentals of Materials Science I (L10	85)	Lecture	2	2	
Fundamentals of Materials Science II (Advanced Ceramic Materials, Polymers and Composites) (L0506)		Lecture	2	2	
Physical and Chemical Basics of Materials	Science (L1095)	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 followin	g learning results			
Professional Competence					
Knowledge	The students have acquired a fundamental knowledge on r	netals, ceramics and polymers a	nd can describe this know	ledge comprehensively.	
	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 f 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 to mechanical properties such as strength, ductility, and stiffness, chemical properties such as corrosion resistance, and to phase transformations such as solidification, precipitation, or melting. The students can explain the relation between processing conditions and the materials microstructure, and they can account for the impact of microstructure on the material's behavior.				
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 Engineer	ring: Compulsory		
Curricula					
	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 Mechanical Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Sp	pecialisation Biomedical Engineerin	g: Compulsory		
	General Engineering Science (German program, 7 semester): Sp	pecialisation Naval Architecture: Co	mpulsory		
	General Engineering Science (German program, 7 semester): Sp	pecialisation Energy and Enviromen	tal Engineering: Compulsor	y	
	Energy and Environmental Engineering: Core qualification: Com	pulsory			
	General Engineering Science (English program): Specialisation	Energy and Enviromental Engineer	ing: Compulsory		
	General Engineering Science (English program): Specialisation	Mechanical Engineering: Compulso	ory		
	General Engineering Science (English program): Specialisation	Biomedical Engineering: Compulso	ry		
	General Engineering Science (English program): Specialisation				
	General Engineering Science (English program, 7 semester): Sp	0			
	General Engineering Science (English program, 7 semester): Sp				
	General Engineering Science (English program, 7 semester): Sp				
	General Engineering Science (English program, 7 semester): Sp		tal Engineering: Compulsory	1	
	Logistics and Mobility: Specialisation Engineering Science: Elec	tive Compulsory			
	Mechanical Engineering: Core qualification: Compulsory				
	Mechatronics: Core qualification: Compulsory				
	Naval Architecture: Core qualification: Compulsory	ativo Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Ele	cuve compulsory			



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	
Тур	
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



Module M0634: Introductio	n into Medical Technology and Systems			
Courses				
Title		Тур	Hrs/wk	CP
Introduction into Medical Technology and Systems (L0342)		Lecture	2	3
Introduction into Medical Technology and	Systems (L0343)	Problem-based Learning	4	3
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 the follow	ing learning results		
Professional Competence				
Knowledge	The students can explain medical technology and its principle	es, including imaging systems, computer a	ided surgery, medical	sensor systems, medical
	information systems. They are able to give an overview of regul	latory affairs and standards in medical tech	nnology.	
Skills	The students are able to apply principles of medical technology	v to solving actual problems.		
on the		to solving addat problems.		
Personal Competence				
Social Competence	The students describe a problem in medical technology as a pr	roject, and define tasks that are solved in a	ioint effort.	
	···· • • • • • • • • • • • • • • • • •			
Autonomy	The students can reflect their knowledge and document the res	ults of their work. They can present the res	sults in an appropriate	manner.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation	on Biomedical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester):	Specialisation Biomedical Engineering: Co	ompulsory	
	Computer Science: Specialisation Computer and Software Eng	ineering: Elective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program): Specialisation	n Biomedical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): S	Specialisation Biomedical Engineering: Co	mpulsory	
	Computational Science and Engineering: Specialisation Engin	eering Sciences: Elective Compulsory		
	Computational Science and Engineering: Specialisation Comp	uter Science: Elective Compulsory		
	Biomedical Engineering: Specialisation Artificial Organs and R	egenerative Medicine: Elective Compulso	ry	
	Biomedical Engineering: Specialisation Implants and Endopros	stheses: Elective Compulsory		
	Biomedical Engineering: Specialisation Medical Technology and	nd Control Theory: Elective Compulsory		
	Biomedical Engineering: Specialisation Management and Busi			
	Technomathematics: Specialisation III. Engineering Science: E			

Course L0342: Introduction into Medical 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 Medical Technology and Systems		
Тур	Problem-based Learning	
Hrs/wk	4	
CP	3	
Workload in Hours	Independent Study Time 34, Study Time in Lecture 56	
Lecturer	Prof. Alexander Schlaefer	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Courses		
ïtle	Typ Hrs/wk CP	
ignals and Systems (L0432)	Lecture 3 4	
ignals and Systems (L0433)	Recitation Section (large) 1 2	
Module Responsible	Prof. Gerhard Bauch	
Admission Requirements	None	
Recommended Previous	Mathematics 1-3	
Knowledge	mationalics FS	
	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 expec 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	
Educational Objectives Professional Competence	After taking part successfully, students have reached the following learning results	
Knowledge	The students are able to elevely and describe signals and linear time invariant (LTI) sustains using methods of signal and sustain theory. They are s	
Skills	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 a caused by the transition of a continuous-time signal to a discrete-time signal. 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		
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 lect	
, atomotiny	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	
Gunicula	General Engineering Science (German program): Specialisation Computer Science: Compulsory	
	General Engineering Science (German program): Specialisation Process Engineering: Computery	
	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: Compulsion	
	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 Engineer Compulsory	
	Computer Science: Core qualification: Compulsory	
	Electrical Engineering: Core qualification: 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 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 Computer Science. Computsory General Engineering Science (English program, 7 semester): Specialisation Process 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 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 Mechatronics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer	
	Compulsory	
	Computational Science and Engineering: Core qualification: Compulsory	
	Mechatronics: Core qualification: Compulsory	



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	
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	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		
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	



Typ Lecture Recitation Section (large)	Hrs/wk	
Lecture	Hrobuk	
Lecture	Hrebuk	
		CP
Recitation Section (large)	3 2	4
	2	2
Sound knowledge of engineering mathematics, engineering mechanics and thermodynamics.		
and the data of the standard and the second s		
reached the following learning results		
nathematical models and are familiar with methods for the p	performance analysis a	nd the prediciton of flui
principles and flow-physics models for the analysis of techn	ical systems. The lectu	re enables the student t
ns for the fluid dynamic design of engineering devices on a s	cientific level.	
nd jointly develop solution strategies.		
rategies for complex problems self-consistent and crtically an	alyse results.	
Lecture 70		
	ompulaan	
	3019	
	ompulsorv	
•		
	reached the following learning results reache	reached the following learning results //edge to explain the general principles of fluid engineering and physics of fluids. S nathematical models and are familiar with methods for the performance analysis a principles and flow-physics models for the analysis of technical systems. The lectu ns for the fluid dynamic design of engineering devices on a scientific level. Ind jointly develop solution strategies. rategies for complex problems self-consistent and crically analyse results. Lecture 70 rram): Specialisation Mechanical Engineering: Compulsory rram): Specialisation Biomedical Engineering: Compulsory rram, 7 semester): Specialisation Biomedical Engineering: Compulsory rram, 7 semester): Specialisation Biomedical Engineering: Compulsory rram, 7 semester): Specialisation Mechanical Engineering: Compulsory rram, 7 semester): Specialisation Naval Architecture: Compulsory pecialisation Engineering: Compulsory rram, 7 semester): Specialisation Naval Architecture: 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	



Module M0960: Mechanics	IV (Kinetics II, Oscillations, Analytical Mechar	ics, Multibody Systems)		
Courses				
		Tun	Hrobule	CP
Title	hutiaal Machanica, Multihadu Suctama) (1,1197)	Typ Lecture	Hrs/wk 3	3
	ılytical Mechanics, Multibody Systems) (L1137) ılytical Mechanics, Multibody Systems) (L1138)	Recitation Section (small)	2	2
	lytical Mechanics, Multibody Systems) (L1139)	Recitation Section (Iarge)	1	1
Module Responsible	Prof. Robert Seifried	(laige)	•	
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	The lang part succession, stadents have reached the long			
Knowledge	The students can			
, nomedge				
	describe the axiomatic procedure used in mechanical	contexts;		
	 explain important steps in model design; 			
	 present technical knowledge. 			
	The students can			
Skills	The students can			
	explain the important elements of mathematical / mech	anical analysis and model formation, and ap	ply it to the context of	their own problems;
	 apply basic methods to engineering problems; 			
	 estimate the reach and boundaries of the methods and 	extend them to be applicable to wider probl	em sets.	
Personal Competence				
Social Competence	The students can work in groups and support each other to ov	ercome difficulties		
Autonomy	Students are capable of determining their own strengths and v	veaknesses and to organize their time and le	arning based on thos	e.
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			
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):		ory	
	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):	Specialisation Mechanical Engineering: Cor	npulsory	
	General Engineering Science (English program, 7 semester):	Specialisation Biomedical Engineering: Con	npulsory	
	General Engineering Science (English program, 7 semester):	Specialisation Naval Architecture: Compulso	ory	
	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			

Course L1137: Mechanics IV (Kineti	ics 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
	- Basics of continuum vibrations
	- Introduction into Modeling of 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).



Course L1138: Mechanics IV (Kinet	ics 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 (Kinet	ics 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	duction to Anatomy			
Courses				
Title		Тур	Hrs/wk	CP
Introduction to Anatomy (L0384)		Lecture	2	3
Module Responsible	Prof. Udo Schumacher	2001010	-	0
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge				
Ũ	The students can describe			
	basal structures and functions of internal organs and the	musculoskeletal system		
	The students can describe the basic macroscopy and m	are seen u of the see quetome		
	The students can describe the basic macroscopy and m	croscopy of mose systems.		
Skills	The students can recognize the relationship between gi	ven anatomical facts and the development of	of common diseases; they c	an explain the relevance
	of structures and their functions in the context of widespr	ead diseases.		
Personal Competence				
	The students can participate in current discussions in bio	omedical research and medicine on a profes	sional level	
Autonomy	The students are able to access anatomical knowledge	ge by themselves, can participate compete	ntly in conversations on th	ne topic and acquire the
	relevant knowledge themselves.			
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28			
	3			
	Written exam			
	90 minutes			
Assignment for the Following	General Engineering Science (German program): Speci	alisation Mechanical Engineering. Focus Bio	mechanics: Compulsorv	
Curricula	General Engineering Science (German program): Speci			
	General Engineering Science (German program, 7 sem	ester): Specialisation Biomedical Engineering	g: Compulsory	
	General Engineering Science (German program, 7 sem	ester): Specialisation Mechanical Engineerin	g, Focus Biomechanics: Co	ompulsory
	Electrical Engineering: Specialisation Medical Technolo	gy: Elective Compulsory		
	General Engineering Science (English program): Specia	alisation Mechanical Engineering, Focus Bio	mechanics: Compulsory	
	General Engineering Science (English program): Specia	alisation Biomedical Engineering: Compulso	ry	
	General Engineering Science (English program, 7 seme	ster): Specialisation Mechanical Engineering	g, Focus Biomechanics: Co	mpulsory
	General Engineering Science (English program, 7 seme	ster): Specialisation Biomedical Engineering	g: Compulsory	-
	Mechanical Engineering: Specialisation Biomechanics:	Compulsory	· · · ·	
	Biomedical Engineering: Specialisation Medical Techno	logy and Control Theory: Elective Compulso	ry	
	Biomedical Engineering: Specialisation Management ar		•	
	Biomedical Engineering: Specialisation Artificial Organs			
	Biomedical Engineering: Specialisation Implants and Er	-		
	Technomathematics: Specialisation III. Engineering Scie			



Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Tobias Lange
Language	DE
Cycle	SoSe
Content	General Anatomy
	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



ourses				
tle		Тур	Hrs/wk	CP
troduction to Radiology and Radiation Th	erapy (L0383)	Lecture	2	3
Module Responsible	Prof. Ulrich Carl			
Admission Requirements	None			
Recommended Previous Knowledge	None			
Educational Objectives	After taking part successfully, students have reached t	ne following learning results		
Professional Competence				
Knowledge	_			
	Therapy			
	The students can distinguish different types of currentl	y used equipment with respect to its use in rad	iation therapy.	
	The students can explain complex treatment plans use	ed in radiation therapy in interdisciplinary conte	exts (e.g. surgery, internal me	edicine).
	The students can describe the patients' passage from	their initial admittance through to follow-up car	e.	
	Diagnostics			
	The students can illustrate the technical base conce imaging techniques (CT, MRT, US).	pts of projection radiography, including ang	iography and mammograph	ny, as well as section
	The students can explain the diagnostic as well as the	rapeutic use of imaging techniques, as well as	the technical basis for those	techniques.
	The students can choose the right treatment method d	epending on the patient's clinical history and n	eeds.	
	The student can explain the influence of technical error	rs on the imaging techniques.		
	The student can draw the right conclusions based on t	he images' diagnostic findings or the error pro	tocol.	
Skills				
OKI13	Therapy			
	The students can distinguish curative and palliative sit	uations and motivate why they came to that co	nclusion	
	The students can develop adequate therapy concepts	and relate it to the radiation biological aspects	S.	
	The students can use the therapeutic principle (effects	vs adverse effects)		
	The students can distinguish different kinds of radiat energy needed in that situation (irradiation planning).	on, can choose the best one depending on	the situation (location of the	tumor) and choose t
	The student can assess what an individual psychoso social services, psycho-oncology).	cial service should look like (e.g. follow-up tre	atment, sports, social help g	roups, self-help grou
	Diagnostics			
	The students can suggest solutions for repairs of imag	ing instrumentation after having done error an	alyses.	
				anatamy nathalagy a
	The students can classify results of imaging technique pathophysiology.	es according to different groups of diseases of	ased on their knowledge of a	anatomy, patriology a
Personal Competence				
Social Competence				
	The students can assess the special social situation of	tumor patients and interact with them in a pro-	fessional way.	
	The students are aware of the special, often fear-domi	nated behavior of sick people caused by diag	nostic and therapeutic meas	ures and can meet the
	appropriately.			
Autonomy				
	The students can apply their new knowledge and skill	s to a concrete therapy case.		
	The students can introduce younger students to the cli	nical daily routine.		
	The students are able to access anatomical knowle	dge by themselves, can participate compete	ntly in conversations on the	e topic and acquire t
	relevant knowledge themselves.	-3)		
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): Spe			
Curricula	General Engineering Science (German program): Spe General Engineering Science (German program, 7 se	• • •		
	General Engineering Science (German program, 7 se			npulsory
	Electrical Engineering: Specialisation Medical Techno			
	General Engineering Science (English program): Spe General Engineering Science (English program): Spe			
	General Engineering Science (English program). Spec			npulsory
	General Engineering Science (English program, 7 ser		-	

Module Manual B. Sc. "General Engineering Science (German program)"



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
CP	3
Workload in Hours	
Lecturer	Prof. Ulrich Carl, Prof. Thomas Vestring
Language	DE SoSe
-	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 f ür 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



modulo mandal D. Co.	. "General Engineering Science (German program)"	tët Hamburg
Module M0684: Heat Trans	fer	
2011/2000		
Courses	Typ Hrs/wk CP	
Fitle Heat Transfer (L0458)	Typ Hrs/wk CP 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 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 approach.	
ecolar competence		
Autonomy	The students are able to develop a complex problem self-consistent and analyse the results in a critical way. A qualified exchange with other students	dents
	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		
Curricula	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory	
000012	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsor	ry
	General Engineering, Focus Energy Systems: Compulsory	,
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engin	ieerir
	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): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory	
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsor	y
	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 Theoretical Mechanical Engine	ieerii
	Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
	Mechanical Engineering: Specialisation Energy Systems: Compulsory	
	Mechanical Engineering: Specialisation Theoretical Mechanical Engineering: 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	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 M0598: Mechanical	Engineering: Design			
Courses				
litle		Typ	Hrs/wk	CP
		Тур		UF 1
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
Feam 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. consider 	ing load situation, materials and manuf	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 doe 			
	 design components based on design guidelines autonomotion 	usly,		
	 dimension (calculate) used components, 			
	 use methods to design and solve engineering design tasks 	systamtically and solution-oriented,		
	 apply creativity techniques in teams. 			
Personal Competence				
Social Competence	After passing the module, students are able to:			
	develop and evaluate solutions in groups including making	and documenting decisions		
		and documenting decisions,		
	 moderate the use of scientific methods, 			
	 present and discuss solutions and technical drawings within 	n groups,		
	 reflect the own results in the work groups of the course. 			
Autonomy	Students are able			
	 to estimate their level of knowledge using activating method 	ods within the lectures (e.g. with clickers	i),	
	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 E	nergy and Enviromental Engineering: C	Compulsory	
Curricula	General Engineering Science (German program): Specialisation M	lechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation E	iomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering: Co	mpulsory	
	General Engineering Science (German program, 7 semester): Spe			
		0 0	1	,
	General Engineering Science (German program, 7 semester): Spe		igineering: Compulsor	1
	Energy and Environmental Engineering: Core qualification: Comp	•		
	General Engineering Science (English program): Specialisation E		ompulsory	
	General Engineering Science (English program): Specialisation M	echanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation B	omedical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Spe		mpulsory	
	General Engineering Science (English program, 7 semester): Spe			
				,
	General Engineering Science (English program, 7 semester): Spec	sansaton Energy and Environmental En	gineering. Compuisory	
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core gualification: Compulsory			



Course L0268: Embodiment Design	and 3D-CAD
	Lecture
Hrs/wk	
	2
CP	
Workload in Hours	
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
Literature	 Deriving technical drawings 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 Konstruktionslemente; 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	ractical Course	
Hrs/wk		
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		
-	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 Desigr	n Methodology		
Тур	roblem-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 M0956: Measureme	nt Technology for Mechanical and Proc	ess Engineers		
Courses				
Title		Typ	Hrs/wk	CP
Practical Course: Measurement and Cont	ol Systems (1 1119)	Typ Laboratory Course	2	2
Measurement Technology for Mechanical		Lecture	2	3
Measurement Technology for Mechanical		Recitation Section (large)	1	1
Module Responsible	Dr. Sven Krause			
Admission Requirements	none			
Recommended Previous	Basic knowledge of physics, chemistry and electrical e	ngineering		
Knowledge	basic knowledge of physics, chemistry and electrical e	ngineering		
Educational Objectives	After taking part successfully, students have reached the	a following learning results		
Professional Competence	Alter taking part successiony, students have reached to	le lonowing learning lesuits		
•			e end lleite lleesstein	h. Calibratian Statia
Knowledge	Students are able to name the most important fundme	entais of the Measurement rechnology (Quantities	s and omits, oncertain	ly, Galibration, Static a
	Dynamic Properties of Sensors and Systems).			
	They can outline the most important measuring metho	ds for different kinds of quantities to be maesured	(Electrical Quantities,	Temperature, mechan
	quantities, Flow, Time, Frequency).			
	They can describe important methods of chemical Ana	Ilysis (Gas Sensors, Spectroscopy, Gas Chromatog	graphy)	
Skills	Students can select suitable measuring methods to give	ven problems and can use refering measurement of	devices in practice.	
	The students are able to orally explain issues in the s	ubject area of measurement technology and solut	tion approaches as we	Il as place the issues
	the right context and application area.			
	5 5			
Personal Competence				
Social Competence	Students can arrive at work results in groups and docu	ment them in a common report.		
Autonomy	Students are able to familiarize themselves with new r	neasurement technologies.		
Westles d'a Desse		2		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 7	0		
Credit points	6			
Examination	Written exam			
Examination duration and scale	105 minutes			
Assignment for the Following	General Engineering Science (German program): Spe		Compulsory	
Curricula	General Engineering Science (German program): Spe	cialisation Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Spe	cialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Spe	cialisation Process Engineering: Compulsory		
	General Engineering Science (German program, 7 ser	mester): Specialisation Energy and Enviromental E	Engineering: Compulso	ory
	General Engineering Science (German program, 7 ser			
	General Engineering Science (German program, 7 ser	mester): Specialisation Biomedical Engineering: C	ompulsory	
	General Engineering Science (German program, 7 ser	mester): Specialisation Process Engineering: Com	pulsory	
	Energy and Environmental Engineering: Core qualification	ation: Compulsory		
	General Engineering Science (English program): Spec		Compulsory	
	General Engineering Science (English program): Spec			
	General Engineering Science (English program): Spec			
	General Engineering Science (English program): Spec			
	General Engineering Science (English program, 7 ser		• • •	ry
	General Engineering Science (English program, 7 ser	, 1 6 6	1	
	General Engineering Science (English program, 7 ser	nester): Specialisation Biomedical Engineering: Co	ompulsory	
	General Engineering Science (English program, 7 ser	nester): Specialisation Process Engineering: Comp	oulsory	
	Mechanical Engineering: Core qualification: Compulse	ory		
	Mechatronics: Core qualification: Compulsory			
	Process Engineering: Core qualification: Compulsory			



ourse L1119: Practical Course: Me	easurement and Control Systems
Тур	Laboratory Course
Hrs/wk	2
CP	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 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
	 Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftlich 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 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 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 Lecturer	Independent Study Time 62, Study Time in Lecture 28	
Language	Dr. Sven Krause DE	
Cycle	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.	

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 M0662: Numerical I	Mathematics I			
Courses				
Title		Тур	Hrs/wk	CP
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 en basic MATLAB knowledge	glish) or Analysis & Linear Algebra I + II fi	or Technomathematiciar	IS
Educational Objectives	After taking part successfully, students have reached the following	ig 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 n 	is,		nding problems and to
Skills	Students are able to			
	 implement, apply and compare numerical methods using justify the convergence behaviour of numerical methods select and execute a suitable solution approach for a giv 	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 theoretica 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 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				
Curricula				
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation		is in Engineering Scienc	es. Compuisory
	General Engineering Science (German program, 7 semester): S		sorv	
	General Engineering Science (German program, 7 semester)			Engineering Sciences
	Compulsory		3,	3
	General Engineering Science (German program, 7 semester): S	pecialisation Biomedical Engineering: Co	ompulsory	
	General Engineering Science (German program, 7 semester): S	pecialisation Mechanical Engineering, Fo	ocus Biomechanics: Com	pulsory
	Bioprocess Engineering: Specialisation A - General Bioprocess	Engineering: Elective Compulsory		
	Computer Science: Specialisation Computational Mathematics:	Elective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation	wechanical Engineering, Focus Biomech	nanics: Compulsory	
		Machanical Engineering Community	o in Englisserie : Ori-	Comedant's
	General Engineering Science (English program): Specialisation			es: Compulsory
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp	pecialisation Computer Science: Compuls	sory	
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester	pecialisation Computer Science: Compuls	sory	
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester Compulsory	ecialisation Computer Science: Computer Specialisation Mechanical Engineerin	sory ng, Focus Materials in	
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester) Compulsory General Engineering Science (English program, 7 semester): Sp	Decialisation Computer Science: Computer Specialisation Mechanical Engineerin Decialisation Biomedical Engineering: Co	sory ng, Focus Materials in mpulsory	Engineering Sciences
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester Compulsory	ecialisation Computer Science: Computer : Specialisation Mechanical Engineering pecialisation Biomedical Engineering: Co pecialisation Mechanical Engineering, Fo	sory ng, Focus Materials in mpulsory	Engineering Sciences



Course L0417: Numerical Mathema	tics I		
Тур	ecture		
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 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 M1279: MED II: Intr	oduction to Biochemistry and Mole	ecular Biology		
Courses				
ïtle		Тур	Hrs/wk	CP
ntroduction to Biochemistry and Molecula	r Biology (1.0386)	Lecture	2	3
Module Responsible	Prof. Hans-Jürgen Kreienkamp	Lookio	L	0
Admission Requirements	None			
Recommended Previous	None			
Knowledge	None			
Educational Objectives	After taking part successfully, students have re	asked the following learning results		
	Alter taking part successionly, students have re	ached the following learning results		
Professional Competence	The students are			
Knowledge	The students can			
	 describe basic biomolecules; 			
	explain how genetic information is code	ed in the DNA;		
	explain the connection between DNA a	and proteins;		
01.11	The students are			
Skills	The students can			
	recognize the importance of molecular	parameters for the course of a disease;		
	describe selected molecular-diagnostic	c procedures;		
	explain the relevance of these procedu	ires for some diseases		
Personal Competence				
Social Competence	The students can participate in discussions in	research and medicine on a technical level.		
Autonomy	The students can develop understanding of top	pics from the course, using technical literature, by thems	selves.	
Workload in Hours	Independent Study Time 62, Study Time in Leo	cture 28		
Credit points	3			
Examination	Written exam			
Examination duration and scale	60 minutes			
Assignment for the Following	General Engineering Science (German progra	m): Specialisation Mechanical Engineering, Focus Bior	nechanics: Compulsory	
Curricula	General Engineering Science (German progra	m): Specialisation Biomedical Engineering: Compulsor	у	
	General Engineering Science (German progra	um, 7 semester): Specialisation Biomedical Engineering	: Compulsory	
	General Engineering Science (German progra	um, 7 semester): Specialisation Mechanical Engineering	, Focus Biomechanics: Co	mpulsory
	Electrical Engineering: Specialisation Medical	Technology: Elective Compulsory		
	General Engineering Science (English program	m): Specialisation Mechanical Engineering, Focus Bior	echanics: Compulsory	
	General Engineering Science (English program	m): Specialisation Biomedical Engineering: Compulsory	/	
	General Engineering Science (English program	m, 7 semester): Specialisation Mechanical Engineering	Focus Biomechanics: Co	mpulsory
	General Engineering Science (English program	m, 7 semester): Specialisation Biomedical Engineering:	Compulsory	
	Mechanical Engineering: Specialisation Biome	echanics: Compulsory		
	Biomedical Engineering: Specialisation Manag	gement and Business Administration: Elective Compuls	ory	
	Biomedical Engineering: Specialisation Artifici	al Organs and Regenerative Medicine: Elective Compu	lsory	
	Biomedical Engineering: Specialisation Medic	al Technology and Control Theory: Elective Compulsor	ý	
	Biomedical Engineering: Specialisation Implan	nts and Endoprostheses: Elective Compulsory		
	Technomathematics: Core qualification: Election	ve Compulsory		
	Technomathematics: Specialisation III. Engine	ering Science: Elective Compulsory		

Course L0386: Introduction to Biochemistry and Molecular Biology		
Тур	Lecture	
Hrs/wk	2	
CP	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	nts and Fracture Healing			
Courses				
Title		Тур	Hrs/wk	CP
mplants 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 Anatom	ie" before attending "Implants and Fractu	ire Healing".	
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following part successfully.	owing learning results		
Professional Competence				
Knowledge	The students can describe the different ways how bones hea	al, and the requirements for their existenc	æ.	
	The students can name different treatments for the spine and	hollow bones under given fracture more	phologies.	
Skills	The students can determine the forces acting within the hum	an body under quasi-static situations und	der specific assumptions.	
Personal Competence				
	The students can, in groups, solve basic numerical modeling	tasks for the calculation of internal force	s.	
Autonomy	The students can, in groups, solve basic numerical modeling	tasks for the calculation of internal force	PS.	
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): Specialisa	ation Mechanical Engineering, Focus Bio	mechanics: Compulsory	
Curricula	General Engineering Science (German program): Specialisa	ation Biomedical Engineering: Compulso	ry	
	General Engineering Science (German program, 7 semester	r): Specialisation Mechanical Engineering	g, Focus Biomechanics: Cor	npulsory
	General Engineering Science (German program, 7 semester	r): Specialisation Biomedical Engineering	g: Compulsory	
	General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsor	ŷ	
	General Engineering Science (English program): Specialisa	tion Mechanical Engineering, Focus Bior	mechanics: Compulsory	
	General Engineering Science (English program, 7 semester	: Specialisation Mechanical Engineering	g, Focus Biomechanics: Com	pulsory
	General Engineering Science (English program, 7 semester	: Specialisation Biomedical Engineering	: Compulsory	
	Mechanical Engineering: Specialisation Biomechanics: Con	npulsory		
	Biomedical Engineering: Specialisation Artificial Organs and	Regenerative Medicine: Elective Comp	ulsory	
	Biomedical Engineering: Specialisation Implants and Endop	rostheses: Elective Compulsory		
	Biomedical Engineering: Specialisation Medical Technology	and Control Theory: Elective Compulso	ry	
	Biomedical Engineering: Specialisation Management and B	usiness Administration: Elective Compute	sory	
	Technomathematics: Specialisation III. Engineering Science	: Elective Compulsory		



rse L0376: Implants and Fractur Typ	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	WiSe Topics to be covered include:
Content	
	1. 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



ourses				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880) roject Entrepreneurship (L0882)		Lecture Problem-based Learning	3 2	3 3
Module Responsible	Prof. Christoph Ihl	FIDDiem-Dased Learning	2	3
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	After taking this module, students know the important basics Marketing and Innovation, and also to Investment and Control		anagement, from Plan	ning and Organisatior
	 explain the differences between Economics and Mana field of Management explain the most important aspects of and goals in Man describe and explain basic business functions as processource management, information management, inn explain the relevance of planning and decision maki some basic methods from mathematical Finance state basics from accounting and costing and selected 	nagement and name the most important asp oduction, procurement and sourcing, supply iovation management and marketing ing in Business, esp. in situations under m	ects of entreprneurial p y chain management, o	projects organization and hurr
Skills	Students are able to analyse business units with respe Entrepreneurship project in a team. In particular, they are able	ect to different criteria (organization, obje	ectives, strategies etc	.) and to carry out
	 analyse Management goals and structure them approperative organisational and staff structures of companier apply methods for decision making under multiple objeter analyse production and procurement systems and Buset analyse and apply basic methods of marketing select and apply basic methods from mathematical fination apply basic methods from accounting, costing and control of the set o	es ectives, under uncertainty and under risk siness information systems ance 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 entreprive to communicate appropriately and 	eneurship project and write a coherent repo	rt on the project	
Autonomy	 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): Specialisati			
Curricula	General Engineering Science (German program): Specialisati General Engineering Science (German program): Specialisati			
	General Engineering Science (German program): Specialisati			
	General Engineering Science (German program): Specialisati	ion Energy and Enviromental Engineering: C	Compulsory	
	General Engineering Science (German program): Specialisati	on Civil- and Enviromental Engeneering: Co	ompulsory	
	General Engineering Science (German program): Specialisati	on Mechanical Engineering: Compulsory		
	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 (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):		-	
		: Specialisation Civil Engineering: Compulso	ory	
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):	: Specialisation Energy and Enviromental Er		
		: Specialisation Energy and Enviromental Er : Specialisation Mechanical Engineering, Fo : Specialisation Mechanical Engineering, Fo : Specialisation Mechanical Engineering, Fo	icus Mechatronics: Cor icus Biomechanics: Co icus Aircraft Systems E	mpulsory ompulsory ingineering: Compulse



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
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 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 Energy and Enviromental 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 Enviromental 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: 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
	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 M1280: MED II: Intr	oduction to Physiology			
Courses				
		T	Hus hade	0.5
Title		Тур	Hrs/wk 2	СР 3
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	g learning results		
Professional Competence				
Knowledge	The students can			
	 describe the basics of the energy metabolism; 			
	 describe physiological relations in selected fields of musc 	le, heart/circulation, neuro- and se	nsory physiology.	
Skills	The students can describe the effects of basic bodily functions	(sensory, transmission and proce	ssing of information, develop	ment of forces and vita
	functions) and relate them to similar technical systems.			
Personal Competence				
Social Competence	The students can conduct discussions in research and medicine			
	The students can find solutions to problems in the field of physiol	ogy, both analytical and metrologic	cal.	
Autonomy	The students can derive answers to questions arising in the course	se and other physiological areas, u	using technical literature, by th	iemselves.
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 Bi	iomechanics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation	Biomedical Engineering: Compuls	sory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Biomedical Engineeri	ng: Compulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineeri	ing, Focus Biomechanics: Cor	npulsory
	Electrical Engineering: Specialisation Medical Technology: Elect	ve Compulsory		
	General Engineering Science (English program): Specialisation I	Mechanical Engineering, Focus Bi	omechanics: Compulsory	
	General Engineering Science (English program): Specialisation I	Biomedical Engineering: Compuls	ory	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Mechanical Engineerii	ng, Focus Biomechanics: Con	npulsory
	General Engineering Science (English program, 7 semester): Spe	ecialisation Biomedical Engineerir	ng: Compulsory	
	Mechanical Engineering: Specialisation Biomechanics: Compuls	•		
	Biomedical Engineering: Specialisation Medical Technology and	Control Theory: Elective Compuls	ory	
	Biomedical Engineering: Specialisation Management and Busine		•	
	Biomedical Engineering: Specialisation Artificial Organs and Reg		pulsory	
	Biomedical Engineering: Specialisation Implants and Endoprosth	eses: Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Electronic Science: Electr	ctive 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



Module M1332: BIO I: Expe	rimental Methods in Biomechanics			
Courses				
Title		Тур	Hrs/wk	CP
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 Fraki	turheilung" before attending "Experimentelle M	lethoden".	
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 morph	nologies.	
	The students can describe different measurement techni	avec for forces and movements, and shapes t	ha adaguata taabaigua far	a given took
	The students can describe different measurement techni	ques for forces and movements, and choose t	ne adequate technique for	a given lask.
Skills	The students can describe the basic handling of several	experimental techniques used in biomechanic	CS.	
D				
Personal Competence				
Social Competence	The students can, in groups, solve basic experimental ta	SKS.		
Autonomy	The students can, in groups, solve basic experimental ta	sks.		
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): Speci	alisation Mechanical Engineering, Focus Biom	nechanics: Compulsory	
Curricula	General Engineering Science (German program): Speci	alisation Biomedical Engineering: Compulsory	/	
	General Engineering Science (German program, 7 seme	ester): Specialisation Mechanical Engineering	, Focus Biomechanics: Cor	npulsory
	General Engineering Science (German program, 7 seme	ester): Specialisation Biomedical Engineering:	Compulsory	
	General Engineering Science (English program): Specia	alisation Biomedical Engineering: Compulsory	,	
	General Engineering Science (English program): Specia	alisation Mechanical Engineering, Focus Biom	echanics: Compulsory	
	General Engineering Science (English program, 7 seme	ster): Specialisation Mechanical Engineering,	Focus Biomechanics: Com	pulsory
	General Engineering Science (English program, 7 seme	ster): Specialisation Biomedical Engineering:	Compulsory	
	Mechanical Engineering: Specialisation Biomechanics:	Compulsory		
	Biomedical Engineering: Specialisation Artificial Organs	and Regenerative Medicine: Elective Comput	sory	
	Biomedical Engineering: Specialisation Implants and Er	doprostheses: Elective Compulsory		
	Biomedical Engineering: Specialisation Medical Techno	logy and Control Theory: Elective Compulsory	/	
	Biomedical Engineering: Specialisation Management ar	nd Business Administration: Elective Compulso	ory	
	Technomathematics: Specialisation III. Engineering Scie			

Course L0377: Experimental Metho	ds 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

Ξ



Specialization Naval Architecture

Module M0933: Fundament	als of Materials Science			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Materials Science I (L10)	35)	Lecture	2	2
Fundamentals of Materials Science II (Adv	vanced Ceramic Materials, Polymers and Composites) (L0506)	Lecture	2	2
Physical and Chemical Basics of Materials	Science (L1095)	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 followin	g learning results		
Professional Competence				
Knowledge	The students have acquired a fundamental knowledge on r	metals, ceramics and polymers a	nd can describe this know	ledge comprehensive
	Fundamental knowledge here means specifically the issues of	atomic structure, microstructure, pha	ase diagrams, phase transf	ormations, corrosion a
	mechanical properties. The students know about the key aspe	ects of characterization methods for	materials and can identify	relevant approaches
	characterizing specific properties. They are able to trace materia	Is phenomena back to the underlyin	g physical and chemical lav	vs of nature.
Skills	The students are able to trace materials phenomena back to the	e underlying physical and chemical	laws of nature. Materials pl	henomena here refers
	mechanical properties such as strength, ductility, and stiffness, o			
	solidification, precipitation, or melting. The students can explain			
	can account for the impact of microstructure on the material's beh	navior.		
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 Engineer	ring: Compulsory	
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation	Biomedical Engineering: Compulse	ory	
	General Engineering Science (German program): Specialisation	Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 semester): Sp		na: Compulsory	
		pecialisation Mechanical Engineerir	·9· ••···	
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp	pecialisation Biomedical Engineerin	g: Compulsory	
		pecialisation Biomedical Engineerin pecialisation Naval Architecture: Co	ng: Compulsory mpulsory	у
	General Engineering Science (German program, 7 semester): Sp	pecialisation Biomedical Engineerin pecialisation Naval Architecture: Co pecialisation Energy and Enviromen	ng: Compulsory mpulsory	у
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp	pecialisation Biomedical Engineerin pecialisation Naval Architecture: Co pecialisation Energy and Enviromen upulsory	g: Compulsory mpulsory Ital Engineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Sg General Engineering Science (German program, 7 semester): Sg Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	pecialisation Biomedical Engineerin pecialisation Naval Architecture: Co pecialisation Energy and Enviromen upulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso	g: Compulsory mpulsory ital Engineering: Compulsor ing: Compulsory ry	у
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	becialisation Biomedical Engineerin becialisation Naval Architecture: Co becialisation Energy and Enviromen upulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulso	g: Compulsory mpulsory ital Engineering: Compulsor ing: Compulsory ry	у
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	becialisation Biomedical Engineerin becialisation Naval Architecture: Co becialisation Energy and Enviromen upulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulsory	g: Compulsory mpulsory ital Engineering: Compulsor ing: Compulsory ory ry	у
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S Energy and Environmental Engineering: Core qualification: Com General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	becialisation Biomedical Engineerin becialisation Naval Architecture: Co becialisation Energy and Enviromen pulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulsory Naval Architecture: Compulsory ecialisation Mechanical Engineerin	g: Compulsory mpulsory ital Engineering: Compulsor ing: Compulsory ory ry g: Compulsory	у
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp 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	becialisation Biomedical Engineerin becialisation Naval Architecture: Co becialisation Energy and Enviromen upulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulsory Vaval Architecture: Compulsory vecialisation Mechanical Engineerin vecialisation Biomedical Engineering	g: Compulsory mpulsory ttal Engineering: Compulsor ing: Compulsory ory g: Compulsory g: Compulsory g: Compulsory	у
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp 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 General Engineering Science (English program, 7 semester): Sp	becialisation Biomedical Engineerin becialisation Naval Architecture: Co becialisation Energy and Enviromen upulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Naval Architecture: Compulsory vecialisation Mechanical Engineerin vecialisation Biomedical Engineering vecialisation Naval Architecture: Cor	g: Compulsory mpulsory ttal Engineering: Compulsor ing: Compulsory ory g: Compulsory g: Compulsory npulsory	
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp 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	becialisation Biomedical Engineerin becialisation Naval Architecture: Co becialisation Energy and Enviromen upulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory vecialisation Mechanical Engineerin vecialisation Biomedical Engineering vecialisation Naval Architecture: Cor vecialisation Energy and Enviromen	g: Compulsory mpulsory ttal Engineering: Compulsor ing: Compulsory ory g: Compulsory g: Compulsory npulsory	
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp 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 Logistics and Mobility: Specialisation Engineering Science: Elec	becialisation Biomedical Engineerin becialisation Naval Architecture: Co becialisation Energy and Enviromen upulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory vecialisation Mechanical Engineerin vecialisation Biomedical Engineering vecialisation Naval Architecture: Cor vecialisation Energy and Enviromen	g: Compulsory mpulsory ttal Engineering: Compulsor ing: Compulsory ory g: Compulsory g: Compulsory npulsory	
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp 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 Logistics and Mobility: Specialisation Engineering Science: Elec Mechanical Engineering: Core qualification: Compulsory	becialisation Biomedical Engineerin becialisation Naval Architecture: Co becialisation Energy and Enviromen upulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory vecialisation Mechanical Engineerin vecialisation Biomedical Engineering vecialisation Naval Architecture: Cor vecialisation Energy and Enviromen	g: Compulsory mpulsory ttal Engineering: Compulsor ing: Compulsory ory g: Compulsory g: Compulsory npulsory	
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp 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 Logistics and Mobility: Specialisation Engineering Science: Elec Mechanical Engineering: Core qualification: Compulsory Mechatronics: Core qualification: Compulsory	becialisation Biomedical Engineerin becialisation Naval Architecture: Co becialisation Energy and Enviromen upulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory vecialisation Mechanical Engineerin vecialisation Biomedical Engineering vecialisation Naval Architecture: Cor vecialisation Energy and Enviromen	g: Compulsory mpulsory ttal Engineering: Compulsor ing: Compulsory ory g: Compulsory g: Compulsory npulsory	
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp 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 Logistics and Mobility: Specialisation Engineering Science: Elec Mechanical Engineering: Core qualification: Compulsory	becialisation Biomedical Engineerin becialisation Naval Architecture: Co becialisation Energy and Enviromen upulsory Energy and Enviromental Engineer Mechanical Engineering: Compulso Naval Architecture: Compulsory becialisation Mechanical Engineerin becialisation Biomedical Engineerin becialisation Naval Architecture: Cor becialisation Energy and Enviromen tive Compulsory	g: Compulsory mpulsory ttal Engineering: Compulsor ing: Compulsory ory g: Compulsory g: Compulsory npulsory	



Course L1085: Fundamentals of Ma	terials 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	

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 		



ourses				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880) roject Entrepreneurship (L0882)		Lecture Problem-based Learning	3	3 3
	Prof. Christoph Ihl	Toblem-based Learning	2	5
Module Responsible Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge	basic relowinge of Mathematics and Dusiness			
Educational Objectives	After taking part successfully, students have reached the foll	lowing learning results		
Professional Competence	· · · · · · · · · · · · · · · · · · ·			
Knowledge	After taking this module, students know the important basic	cs of many different areas in Business and Ma	inagement, from Plan	ning and Organisation
Ū	Marketing and Innovation, and also to Investment and Contr		0	0 0
	explain the differences between Economics and Mar	nagement and the sub-disciplines in Managen	ient and to name impo	ortant definitions from i
	field of Management	longement and name the meet important con		araiaata
	 explain the most important aspects of and goals in M describe and explain basic business functions as p 	• • •		-
	ressource management, information management, in		chain management,	organization and nun
	 explain the relevance of planning and decision ma 	• •	ultiple objectives and	uncertainty, and expl
	some basic methods from mathematical Finance	0		
	 state basics from accounting and costing and selected 	ed controlling methods.		
Skills	Students are able to analyse business units with resp		ctives, strategies etc	.) and to carry out
	Entrepreneurship project in a team. In particular, they are ab	ole to		
	analyse Management goals and structure them appr	ropriately		
	analyse organisational and staff structures of compa	inies		
	apply methods for decision making under multiple of	bjectives, under uncertainty and under risk		
	analyse production and procurement systems and B	Business information systems		
	 analyse and apply basic methods of marketing 			
	 select and apply basic methods from mathematical fit 			
	 apply basic methods from accounting, costing and control 	ontrolling 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 entre	preneurship project 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 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialis	ation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialis	ation Computer Science: Compulsory		
	General Engineering Science (German program): Specialis	ation Process Engineering: Compulsory		
	General Engineering Science (German program): Specialis	ation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialis	ation Energy and Enviromental Engineering: C	ompulsory	
	General Engineering Science (German program): Specialis	ation Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (German program): Specialise	ation Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialise	ation Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialis	ation Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste	, ,	-	
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste		-	
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste			
		eru: Specialisation Mechanical Engineering, For	cus Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste	er): Specialisation Mechanical Engineering, Fo		
	General Engineering Science (German program, 7 semeste General Engineering Science (German program, 7 seme	er): Specialisation Mechanical Engineering, Fo		
	General Engineering Science (German program, 7 semeste	r): Specialisation Mechanical Engineering, For ester): Specialisation Mechanical Engineerin	g, 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 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 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 Energy and Enviromental 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 Enviromental 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: 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			
	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 Man 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			
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 M0854: Mathematic	os IV			
Courses				
Title		Тур	Hrs/wk	CP
Differential Equations 2 (Partial Differentia		Lecture	2	1
Differential Equations 2 (Partial Differentia		Recitation Section (small)	1	1
Differential Equations 2 (Partial Differentia	Equations) (L1045)	Recitation Section (large)	1	1
Complex Functions (L1038)		Lecture Recitation Section (small)	2	1
Complex Functions (L1041) Complex Functions (L1042)		Recitation Section (small)	1	1
Module Responsible	Prof. Anusch Taraz	rionalish costion (argo)	·	•
Admission Requirements	none			
Recommended Previous	Mathematics 1 - III			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge				
Knowledge	Students can name the basic concepts in Mathe	matics IV. They are able to explain them using appr	opriate examples.	
	Students can discuss logical connections betwe	en these concepts. They are capable of illustrating	these connections wi	th the help of example
	• They know proof strategies and can reproduce the	hem.		
Skills				
Skills	Students can model problems in Mathematics IV	/ with the help of the concepts studied in this cours	e. Moreover, they are	capable of solving the
	by applying established methods.			
	 Students are able to discover and verify further log 	ogical connections between the concepts studied in	the course.	
	 For a given problem, the students can develop a 	•		eulte
	• Tor a given problem, the students can develop a	ind execute a suitable approach, and are able to ch	lically evaluate the re-	30113.
Personal Competence				
Social Competence	- Oudersteinen alste teine deteinetten in teinen. The	and the second		
	Students are able to work together in teams. The			
	 In doing so, they can communicate new concept 		iners. Moreover, they	can design examples
	check and deepen the understanding of their pe	ers.		
Autonomy				
,	 Students are capable of checking their understand 	anding of complex concepts on their own. They ca	n specify open quest	ions precisely and kn
	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 p	roblems.
	Independent Study Time 68, Study Time in Lecture 112			
Workload in Hours				
Workload in Hours Credit points Examination				
Credit points	6 Written exam			
Credit points Examination	6	tions 2)		
Credit points Examination Examination duration and scale	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec	tions 2) ialisation Electrical Engineering: Compulsory	nics: Compulsorv	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro		ering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic		eering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory	al Mechanical Engine	eering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp	al Mechanical Engine	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc	al Mechanical Engine ulsory us Mechatronics: Cor	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc	al Mechanical Engine ulsory us Mechatronics: Cor	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 se General Engineering Science (German program, 7 se	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering,	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 se General Engineering Science (German program, 7 se	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso ematics: Elective Compulsory	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso ematics: Elective Compulsory alisation Electrical Engineering: Compulsory	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Speci	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso ematics: Elective Compulsory alisation Electrical Engineering: Compulsory alisation Naval Architecture: Compulsory	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical M ory	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Speci General Engineering Science (English program): Speci	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory enters: Elective Compulsory alisation Electrical Engineering: Compulsory alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical M pry nics: Compulsory	npulsory Aechanical Engineeri
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Theoretic ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso ematics: Elective Compulsory alisation Electrical Engineering: Compulsory alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic	al Mechanical Engine ulsory us Mechatronics: Con Focus Theoretical M ory nics: Compulsory al Mechanical Engine	npulsory Aechanical Engineeri
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program): Speci	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso ematics: Elective Compulsory alisation Electrical Engineering: Compulsory alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic aster): Specialisation Electrical Engineering; Comp	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical M ory nics: Compulsory al Mechanical Engine Jlsory	npulsory Aechanical Engineerii ering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program, 7 sem General Engineering Science (English program) (English program) (English program) (English program) (En	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory ester): Specialisation Naval Architecture: Compulsory alisation Electrical Engineering: Compulsory alisation Naval Architecture: Compulsory alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Focus atsol Mechanical Engineering, Focus Theoretic ester): Specialisation Mechanical Engineering, Focus	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ory nics: Compulsory al Mechanical Engine Jlsory us Mechatronics: Corr	npulsory Aechanical Engineeri ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program, 7 sem General Engineering Science (English program), 7 sem G	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory ester): Specialisation Naval Architecture: Compulsory alisation Electrical Engineering: Compulsory alisation Naval Architecture: Compulsory alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Focus atsol Mechanical Engineering, Focus Theoretic ester): Specialisation Mechanical Engineering, Focus	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ory nics: Compulsory al Mechanical Engine Jlsory us Mechatronics: Corr	npulsory Aechanical Engineeri ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program, 7 sem General Engineering Science (English program), 7 sem General Engineering Science (English program), 7 sem	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor enters: Elective Compulsory alisation Electrical Engineering: Compulsory alisation Naval Architecture: Compulsory alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic ester): Specialisation Electrical Engineering: Compu- seter): Specialisation Mechanical Engineering, Focus attribution Mechanical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ory nics: Compulsory al Mechanical Engine Jlsory us Mechatronics: Corr Focus Theoretical M	npulsory Aechanical Engineeri ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program, 7 sem General Engineering Science (English program), 7 sem G	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor enters: Elective Compulsory alisation Electrical Engineering: Compulsory alisation Naval Architecture: Compulsory alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic ester): Specialisation Electrical Engineering: Compu- seter): Specialisation Mechanical Engineering, Focus attribution Mechanical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ory nics: Compulsory al Mechanical Engine Jlsory us Mechatronics: Corr Focus Theoretical M	npulsory Aechanical Engineeri ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program, 7 sem General Engineering Science (English program), 7 sem General Engineering Science (English program), 7 sem	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory alisation Electrical Engineering: Compulsory alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic ester): Specialisation Electrical Engineering, Focus ester): Specialisation Mechanical Engineering,	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ory nics: Compulsory al Mechanical Engine Jlsory us Mechatronics: Corr Focus Theoretical M	npulsory Aechanical Engineeri ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program, 7 sem General Engin	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory alisation Electrical Engineering: Compulsory alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic ester): Specialisation Electrical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus ester): Specialisation Naval Architecture: Compulsory h Engineering Sciences: Elective Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ory nics: Compulsory al Mechanical Engine Jlsory us Mechatronics: Corr Focus Theoretical M	npulsory Aechanical Engineeri ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program, 7 sem General Engineering Science (English program, 7 sem Gompulsory General Engineering Science (English program, 7 sem Computational Science and Engineering: Specialisation	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory alisation Electrical Engineering: Compulsory alisation Electrical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus ester): Specialisation Naval Architecture: Compulsory in Computer Sciences: Elective Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ory nics: Compulsory al Mechanical Engine Jlsory us Mechatronics: Corr Focus Theoretical M	npulsory Aechanical Engineeri ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program, 7 sem General Engineering Science (English program, 7 sem Compulsory General Engineering Science (English program, 7 sem Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Me	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory alisation Electrical Engineering; Compulsory alisation Electrical Engineering; Focus Mechatro alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic ester): Specialisation Electrical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus engineering Sciences: Elective Compulsory n Computer Science: Elective Compulsory chanical Engineering: Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ory nics: Compulsory al Mechanical Engine Jlsory us Mechatronics: Corr Focus Theoretical M	npulsory Aechanical Engineeri ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program, 7 sem General Engineering Science (English program, 7 sem Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Me Mechanical Engineering: Specialisation Mechatronics:	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory alisation Electrical Engineering; Compulsory alisation Electrical Engineering; Focus Mechatro alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic ester): Specialisation Electrical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus engineering Sciences: Elective Compulsory n Computer Science: Elective Compulsory chanical Engineering: Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ory nics: Compulsory al Mechanical Engine Jlsory us Mechatronics: Corr Focus Theoretical M	npulsory Aechanical Engineeri ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program, 7 sem General Engineering Science (English program, 7 sem Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Me Mechanical Engineering: Specialisation Mechatronics: Mechatronics: Core qualification: Compulsory	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory alisation Electrical Engineering; Compulsory alisation Electrical Engineering; Focus Mechatro alisation Naval Architecture: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic ester): Specialisation Electrical Engineering, Compu- ester): Specialisation Mechanical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus enseter): Specialisation Mechanical Engineering, Focus enseter): Specialisation Naval Architecture: Compulsory in Engineering Sciences: Elective Compulsory chanical Engineering: Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ory nics: Compulsory al Mechanical Engine Jlsory us Mechatronics: Corr Focus Theoretical M	npulsory Aechanical Engineeri ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equa General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mathe Electrical Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program, 7 sem General Engineering Science (English program, 7 sem Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Me Mechanical Engineering: Specialisation Mechatronics:	tions 2) ialisation Electrical Engineering: Compulsory ialisation Mechanical Engineering, Focus Mechatro ialisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc emester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory alisation Electrical Engineering; Compulsory alisation Electrical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic ester): Specialisation Electrical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus enester): Specialisation Mechanical Engineering, Focus engineering Sciences: Elective Compulsory h Computer Science: Elective Compulsory Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ory nics: Compulsory al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry	npulsory Aechanical Engineeri ering: Compulsory Ipulsory



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	
CP	1
	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
	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



Module M0960: Mechanics	IV (Kinetics II, Oscillations, Analytical Mechan	ics, Multibody Systems)		
Courses				
		Tun	Hrobyle	CD
Fitle		Тур	Hrs/wk	CP
	alytical Mechanics, Multibody Systems) (L1137)	Lecture Recitation Section (small)	3 2	3 2
	alytical Mechanics, Multibody Systems) (L1138) alytical Mechanics, Multibody Systems) (L1139)	Recitation Section (small)	2	2
Module Responsible		necitation Section (large)	I	1
Admission Requirements	none			
Recommended Previous	Mathematics I-III and Mechanics I-III			
Knowledge	Mathematics I-III and Mechanics I-III			
°		ing lagging gauge		
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 	contexts;		
	 explain important steps in model design; 			
	 present technical knowledge. 			
	· ·			
Skills	The students can			
	explain the important elements of mathematical / mech	anical analysis and model formation, and an	nly it to the context of	their own problems:
	 apply basic methods to engineering problems; 			anen own problems,
	 estimate the reach and boundaries of the methods and 	extend them to be applicable to wider problem	omicoto	
	• estimate the reach and boundaries of the methods and	extend them to be applicable to wider proble	eni sets.	
Personal Competence				
Social Competence	The students can work in groups and support each other to ov	ercome difficulties.		
Autonomy	Students are capable of determining their own strengths and v	veaknesses and to organize their time and le	arning based on thos	e.
,		······································	3	-
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	on Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisati	on Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisati			
	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 (English program): Specialisatio			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program, 7 semester):		npulsory	
	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):			
	Mechanical Engineering: Core qualification: Compulsory	oposition nava Architecture. Compuiso	·· <i>j</i>	
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: E	ciective Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			
	Theoretical Mechanical Engineering: Technical Complementa	ry Course Core Studies: Elective Compulsor	у	

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	
	- Basics of continuum vibrations	
	- Introduction into Modeling of 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).	



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 (Kinet	ics 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 M0680: Fluid Dyna	mics				
Courses					
Courses					
Title		Тур	Hrs/wk	CP	
Fluid Mechanics (L0454) Fluid Mechanics (L0455)		Lecture Recitation Section (large)	3 2	4	
	Dref Themes Dure	necitation Section (large)	2	2	
Module Responsible	Prof. Thomas Rung				
Admission Requirements	none				
Recommended Previous					
Knowledge					
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results			
Professional Competence					
Knowledge	Students will have the required sound knowledge to explain t				
	outline the rationale of flow physics using mathematical mod	els and are familiar with methods for the po	erformance analysis a	and the prediciton of flu	
	engineering devices.				
Skills	Students are able to apply fluid-engineering principles and flo	w-physics models for the analysis of techni	cal systems. The lectu	re enables the student	
	carry out all necessary theoretical calculations for the fluid dyn		-		
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	ex problems 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): Specialisati	on Mechanical Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisati	on Biomedical Engineering: Compulsory			
	General Engineering Science (German program): Specialisati	on Naval Architecture: Compulsory			
	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 Naval Architecture: Compuls	ory		
	General Engineering Science (English program): Specialisation	n 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, 7 semester): Specialisation Mechanical Engineering: Compulsory				
	General Engineering Science (English program, 7 semester):	Specialisation Biomedical Engineering: Cor	npulsory		
	General Engineering Science (English program, 7 semester):	Specialisation Naval Architecture: Compulse	ory		
	Computational Science and Engineering: Specialisation Engin	neering Sciences: Elective Compulsory			
	Mechanical Engineering: Core qualification: Compulsory				
	Naval Architecture: Core qualification: 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	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)		Recitation Section (small)	1	1
Statistics and Stochastic Processes in Na	val Architecure and Ocean Engineering (L0364)	Lecture	2	3
Module Responsible	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 f	ollowing learning results		
Professional Competence				
Knowledge	- The students are able to give an overview over various	s manoeuvres. They can name application goa	Is and they can desc	ribe the procedure of th
	manoeuvres.			
	- The students are able to give an overview over varius rue	dder types. They can name criteria in the rudder	design.	
	The state of the second st			
	- The students can name computation methods which are	used to determine forces and motions in waves	•	
Skills	- The students can come up with the equations of motions	which are used to discribe manoeuvres. The ca	n use and linearise th	em.
	- The students are able to determine hydrodynamic coeffic	cients and they can explain their physical meani	ng.	
			-	
	- The students can explain how a rudder works and they c	an explain the physical effects which can occur.		
	- The students can mathematically describe waves.			
	- The students can explain the mathematically description	of harmonoial motions in wayos and they can d	otormino thom	
	- The students can explain the mathematically description	of hamolicial motions in waves and they can d	etermine trem.	
Personal Competence				
Social Competence	- The students can arrive at work results in groups and do	cument them.		
	- The students can discuss in groups and explain their poi	nt of view.		
Autonomy	- The students can assess their own strengthes and weak	nesses and the define further work steps on this	basis.	
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): Special	isation Naval Architecture: Compulsory		
Curricula	General Engineering Science (German program, 7 semes		sory	
	General Engineering Science (English program): Speciali			
	General Engineering Science (English program, 7 semes	ter): Specialisation Naval Architecture: Compuls	ory	
	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
Content	
	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	ourse 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 Stoch	astic Processes in Naval Architecure and Ocean Engineering
Тур	Lecture
Hrs/wk	2
CP	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, 3rd 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: Computatio	nal Fluid Dynamics I			
2				
Courses				
Title		Тур	Hrs/wk	CP
Computational Fluid Dynamics I (L0235) Computational Fluid Dynamics I (L0419)		Lecture Recitation Section (large)	2	3 3
	Prof. Thomas Rung	recitation Section (large)	2	5
	None			
Recommended Previous	None			
Knowledge	 Mathematical Methods for Engineers 			
Knowledge	 Fundamentals of Differential/integral calculus and 	d series expansions		
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	The students are able to list the basic numerics of partia	differential equations.		
Skills	The students are able develop appropriate numerical	integration in space and time for the governing	g partial differential e	quations. They can code
	computational algorithms in a structured way.			
Personal Competence				
Social Competence	The students can arrive at work results in groups and do	cument them.		
Autonomy	The students can independently analyse approaches to	solving specific 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): Speci	alisation Mechanical Engineering, Focus Energy	Systems: Compulsory	
Curricula	General Engineering Science (German program): Speci	alisation Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 sem	ester): Specialisation Naval Architecture: Compute	sory	
	General Engineering Science (German program, 7 sem	ester): Specialisation Mechanical Engineering, Fo	ocus Energy Systems:	Elective Compulsory
	General Engineering Science (English program): Specia	alisation Naval Architecture: Compulsory		
	General Engineering Science (English program): Specia	alisation Mechanical Engineering, Focus Energy S	Systems: Compulsory	
	General Engineering Science (English program, 7 seme	ester): Specialisation Naval Architecture: Compuls	ory	
	General Engineering Science (English program, 7 seme	ester): Specialisation Mechanical Engineering, For	cus Energy Systems: I	Elective Compulsory
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Scie	ence: Elective Compulsory		
	Technomathematics: Specialisation III. Engineering Scie	ence: Elective Compulsory		

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.	
	1. Partial differential equations	
	2. 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	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 M0659: Fundament	tals of Ship Structural Design and Analysi	s		
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Ship Structural Design (L	_0411)	Lecture	2	2
Fundamentals of Ship Structural Design (L	_0413)	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			
	Welding Technology I			
	Fundamentals of Mechanical Design I - III			
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	Students can reproduce the basic contents of the structu	ral behaviour of ship structures; they can expla	in the theory and met	hods for the calculation o
	deformations and stresses in beam-like structures.			
	Eurthermore, they can reproduce the basis contents of	andra (rulas) materiala comi finichad produc	b joining and princip	loo of atructural design o
	Furthermore, they can reproduce the basis contents of	codes (rules), materials, semi-infished produc	is, joining and princip	les of structural design o
	components in the ship structure.			
Skills	Students are capable of applying the methods and tools	for the calculation of linear deformations and s	stresses in the above r	mentioned structures; they
	can choose calculation models of typical ship structures.			
	Furthermore, they are capable to apply the methods of d	rawing and sizing the ship structure: they can	select suitable materia	als, semi-finished products
	and joints.	,		··-,
Personal Competence				
Social Competence	The students are able to communicate and cooperate in a	a professional environment in the shipbuilding a	and component supply	industry
Coolar Competence				maasay.
Autonomy	The students are capable to independently idealize real ship structures and to select suitable methods for analysis of beam-like structures; they are			
	capable to assess the results of structural analyses.			
	Furthermore, they are earphic to eace drawing of a	ampley ship structures and to design ship structures	uctures for verious	uiromonte and hourdan
	Furthermore, they are capable to assess drawings of c	omplex ship structures and to design ship stri	uctures for various rec	quirements and boundary
	conditions.			
Workload in Hours	Independent Study Time 156, Study Time in Lecture 84			
Credit points	8 Mailtan augus			
	Written exam			
Examination duration and scale	3 hours			
Assignment for the Following	General Engineering Science (German program): Specia			
Curricula	General Engineering Science (German program, 7 seme		lsory	
	General Engineering Science (English program): Special	1 3		
	General Engineering Science (English program, 7 semes	ster): Specialisation Naval Architecture: Compul	sory	
	Naval Architecture: Core qualification: Compulsory			



Course L0411: Fundamentals of Ship Structural Design		
Тур	Lecture	
Hrs/wk	2	
CP	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	
	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	
	9. 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	
CP	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	
	9. 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	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Sören Ehlers	
Language	DE	
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	Recitation 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	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	

r



Courses				
Title		Тур	Hrs/wk	CP
Ship Structural Design (L0412)		Lecture	2	3
Ship Structural Design (L0415)		Recitation Section (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 ship structures a	and of different ship ty	/pes (incl. detail desig
	they can describe calculation models for complex s	tructures.		
Skills	Students are capable to specify the requirements	for different ship types and areas of the hull, to define	design criteria for th	ne components, to sele
	suitable calculation models and to assess the chos			· · · · · · · · · · · · · · · ·
Personal Competence				
Social Competence	Students are capable to present their structural des			
	Sudents are capable to present their structural design and discuss their decisions constructively in a group.).	
		ign and discuss their decisions constructively in a group).	
Autonomy	Students are capable to design independently dif	ign and discuss their decisions constructively in a group ierent structural areas of the ship hull and different shi		e appropriate fabricati
Autonomy	Students are capable to design independently diff methods.			e appropriate fabricati
Autonomy				e appropriate fabricati
Autonomy				e appropriate fabricati
Autonomy				e appropriate fabricati
	methods.	erent structural areas of the ship hull and different shi		e appropriate fabricati
Workload in Hours	methods. Independent Study Time 172, Study Time in Lecture	erent structural areas of the ship hull and different shi		e appropriate fabricati
Workload in Hours Credit points	methods. Independent Study Time 172, Study Time in Lecture 9	erent structural areas of the ship hull and different shi		e appropriate fabricati
Workload in Hours Credit points Examination	methods. Independent Study Time 172, Study Time in Lecture 9 Written exam	erent structural areas of the ship hull and different shi		e appropriate fabricati
Workload in Hours Credit points Examination Examination duration and scale	methods. Independent Study Time 172, Study Time in Lecture 9 Written exam 3 hours	erent structural areas of the ship hull and different shi		e appropriate fabricati
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	methods. Independent Study Time 172, Study Time in Lecture 9 Written exam 3 hours General Engineering Science (German program): S	e 98	p types and to define	e appropriate fabricati
Workload in Hours Credit points Examination Examination duration and scale	methods. Independent Study Time 172, Study Time in Lecture 9 Written exam 3 hours General Engineering Science (German program): S	erent structural areas of the ship hull and different shi	p types and to define	e appropriate fabricati
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	methods. Independent Study Time 172, Study Time in Lecture 9 Written exam 3 hours General Engineering Science (German program): S	e 98 specialisation Naval Architecture: Compulsory semester): Specialisation Naval Architecture: Compulsory	p types and to define	e appropriate fabricati
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	methods. Independent Study Time 172, Study Time in Lecture 9 Written exam 3 hours General Engineering Science (German program): S General Engineering Science (German program, 7 General Engineering Science (English program): S	e 98 specialisation Naval Architecture: Compulsory semester): Specialisation Naval Architecture: Compulsory	p types and to define	e appropriate fabricati

Course L0412: Ship Structural Design		
Тур	Lecture	
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:	
	 Bulkheads and tanks Structural design of forebodies Structures in engine rooms Aft bodies and rudders Detail structural design Outfitting Stuctures Tankers Container ships Production-kind steel structural design Buckling and ultimate strength 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:	
	 Bulkheads and tanks Structural design of forebodies Structures in engine rooms Aft bodies and rudders Detail structural design Outfitting Sult carriers Tankers Container ships Oproduction-kind steel structural design Buckling and ultimate strength 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
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Claus Emmelmann, Prof. Karl-Ulrich Kainer
Language	DE
Cycle	
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.
	1



Module M1109: Resistance	and Propulsion			
Courses				
Title		Тур	Hrs/wk	CP
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	Mechanics			
Knowledge	Initial Provide State of Naval Architects			
	Hydrostratics			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The hydrodynamic basics that are relevant for resistance and pro	pulsion of ships are discussed. The diff	erent resistance phen	omena and their practica
	applications to hullform design as well as numerical and empirica	al prediction methods are subject of the	course. Furthermore,	environmental additiona
	resistances are dealt with. The course includes model test tec	hniques and their application to full s	cale ships. This hold	also for propulsion and
	hullefficiency elements, mainly thrust deduction and wake. M	ain Focus is how hull forms can be	optimized for minimu	um and sustainable fue
	consumption. The following topics are dealt with:			
	- Stillwater/added resistance, Wave resistance, Minimization of	wave resistance, numerical prediction	methods. friction lav	vs. laminar/turbulent flov
	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 matters concerning speed/power, bunker claims			
Skills	The student shall learn to design competitve hull forms with respect to fuel consumption by applying numreical techniques and to evaluate these hulls			
	by several progosis methods. Furtermore, the course will en	nable the student to clearl determine	and minimize the re	equired power including
	environmental influences.			
Personal Competence				
	The student learns to prepare technical matters in such a way that	he can compte with his building suverv	sion team.	
Autonomy				
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): Specialisation I	Vaval Architecture: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Spe		sory	
	General Engineering Science (English program): Specialisation N	laval Architecture: Compulsory		
	General Engineering Science (English program, 7 semester): Spe	cialisation Naval Architecture: Compuls	ory	
	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: Hydrostatio	es and Body Plan			
Courses				
Title		Тур	Hrs/wk	CP
Hydrostatics (L1260)	Lecture 2 3			
Hydrostatics (L1261) Recitation Section (large) 2 1				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-III.			
Knowledge				
	It is recommended that the students are familiar with typical de	esign relevant drawings, e.g. Body Plan, GA-	Plan, Tank Plan etc.	
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	The lecture enables the student to carry out all necessary theoretical calculations for ship design on a scientific level. The lecture is basic requirement fo			e is basic requirement for
	all following lectures in the subjects shipo design and safety of ships.			
			able to de close by U.G.	
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 the		orms that are safe agains		
	capsizing or sinking.			
Personal Competence				
Social Competence	The student gets access to hydrostatical problems.			
Autonomy				
	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): Specialisati	on Naval Architecture: Compulsory		
Curricula	General Engineering Science (German program, 7 semester):	Specialisation Naval Architecture: Compulse	ory	
	General Engineering Science (English program): Specialisation	on Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 semester):	Specialisation Naval Architecture: Compulso	ry	
	Naval Architecture: Core qualification: Compulsory			

Course L1260: Hydrostatics		
Тур	Lecture	
Hrs/wk		
CP		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Stefan Krüger	
Language		
Cycle		
	- Trapezoidal Rule, Simpson, Tschebyscheff, graphical Integration Methods	
	- Determination of Areas, 1st and 2nd order Moments	
	- Numerical Diffrentation, Spline Interpolation	
	2. Buyoancy	
	- Principle of Archimedes	
	- Equilibrium Floating Condition	
	- Equilibrium 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	
	[163]	



D. 30.	General Engineering Science (German program)
	- 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

Literature 1. Herner/Rusch: Die Theorie des Schiffes Fachbuchverlag Leipzig



 Henschke Schiffstechnisches Handbuch, Band 1 VEB Technik Verlag Berlin
 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.



Module M1110: Ship Desig	n				
Courses					
		True	Line hade	0.0	
Title		Тур	Hrs/wk	CP	
Ship Design (L1262) Ship Design (L1264)		Lecture Recitation Section (large)	2	3 3	
Module Responsible	Prof. Stefan Krüger	ricolation occilion (large)	L	0	
Admission Requirements	None				
Recommended Previous	TNOTE				
Knowledge	 Fluid Dynamics for Naval Architects, Resistance and Prop 	pulsion			
Ritowicage	Resistance and Propulsion, Hydrostatics				
Educational Objectives	After taking part successfully, students have reached the followin	a learning results			
Professional Competence	Alter taking part successionly, students have reached the following	gleaning lesuis			
Knowledge	The least restarts with an even iow about the importance and	requirements of the party design phase	o Compotitivo Elomo	nte of Shin Dociane	
Knowledge	The lecture starts with an overview about the importance and the relation				
	thoroughly discussed. Typical building contracts and the related technical risk are introduced. The most important main parameters of a ship and introduced and their influence on the competitiveness of a design. The leature forwards on the influence of alternated main parameters on the tot				
	introduced and their influence on the competitiveness of a design. The lecture focusses on the influence of alternated main parameters on the tota performance of a ship design and the consecutive process elements. In this lecture, the design changes are dealt with by simple models or formulae				
	The student shall further learn to model complex systems proper		-		
	The lecture continues with an introduction into the different phases of design project, from the initial design phase to a building contract. Further, methods				
	are introduced to generate bulding specification relevant information at different levens of granularity during the different design stages. In detail, the				
	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 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	The student is made familiar with the basic design principles o	f seagoing mearchant ships. The goal of	the lecture is that the	student shall be able	
	carry out a concept design based on a vessel of comparison fulfi	lling typical contract requirements within	the Marine Environme	nt. The lecture deals w	
	the basic design methods to determine the fundamantal technical characteristics of a ship design with respect to fulfillment procedures of the contract				
	values. Based on the lecture "Principles of Ship Design" the relevant	vant methods to determine and judge uop	n the performance of a	a ship design are treat	
Borocnal Competence					
Personal Competence	The students learne to propare technical matters is such a way th	a ha ann parsuada his patantial sustant	r against his same -		
	The students learns to prepare technical matters in such a way the The students learns to prepare technical matters in such a way the				
Autonomy	יווים אמעפרונג ופארוג וט טופטאים ופכווווכאו וואננפרג ווו געלה א way נד	e ne can persuade nis potantial custome	against his competito	no.	
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): Specialisation	1 3			
Curricula	General Engineering Science (German program, 7 semester): Sp		ory		
	General Engineering Science (English program): Specialisation				
	General Engineering Science (English program, 7 semester): Sp	ecialisation Naval Architecture: Compuls	ory		
	Naval Architecture: Core qualification: Compulsory				

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		



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 experises 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.

Module M0886: Fundamentals of Process Engineering Courses Title Тур Hrs/wk CP Introduction into Process Engineering/Bioprocess Engineering (L0829) Lecture 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 reached the following learning results Professional Competence Knowledge After passing this module the students have the ability to: • give an overview of the most important fields on process and bioprocess engineering, • explain some working methods for different fields in process engineering. Skills After passing this module the students should have the ability to: • list and outline the most important fields of process engineering, • name the most important working approaches or methods of the different fields of process engineering, · read and prepare an engineering drawing, explain the most important technologies for wastewater and exhaust air treatment scheme typical chemical and biotechnological processes independently with the aid of pointers. Personal Competence Social Competence The students are able to • work out results in groups and document them, provide appropriate feedback and handle feedback on their own performance constructively. Autonomy The students are able to estimate their progress of learning by themselves and to deliberate their lack of knowledge in Process Engineering and **Bioprocess Engineering** Workload in Hours Independent Study Time 34, Study Time in Lecture 56 Credit points Examination Written exam Examination duration and scale 90 min General Engineering Science (German program): Specialisation Process Engineering: Compulsory Assignment for the Following Curricula General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program): Specialisation Process Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory Process Engineering: Core qualification: Compulsory



Course L0829: Introduction into Process Engineering/Bioprocess Engineering	
Тур	Lecture
Hrs/wk	2
CP	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.
	0, 10
Literature	s. Studi

Course L0830: Fundamentals of ma	terial engineering		
Тур	Lecture		
Hrs/wk	2		
CP			
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 Cl	nemistry			
Courses				
Title		Тур	Hrs/wk	CP
Physical Chemistry (L0833)		Lecture	2	2
Physical Chemistry (L0835)		Laboratory Course	2	1
Module Responsible	Prof. Hans-Ulrich Moritz			
Admission Requirements	None			
Recommended Previous	Contents of the previous modules inorganic chemistry, physics for	engineers and mathematics I-III.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning 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-, he	at- and momentum transfer.		
	- to interpret phase diagrams and affiliate kinetic rate laws.			
Skills	The students are able to			
	- conduct (fundamental) thermodynamical, electrochemical and ki	netic calculations.		
	- assess new applications with respect to environmental sustainal	pility.		
	- abstract their knowldege to related issues to conduct thermodyna	amical, electrochemical and kinetic cal	culations.	
Personal Competence				
Social Competence	The students are able to plan, prepare, conduct and document exp	periments according to scientific guide	lines in small groups.	
	The students are able to reflect their subject-specific knowledge o	ally in a team and to discuss it with fel	llow students and faculty	
Autonomy	Students are able to assess their knowldege continuously on their	r own by exemplified practice. Studen	ts 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 F	Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation E			
	General Engineering Science (German program, 7 semester): Spe		pulsory	
	General Engineering Science (German program, 7 semester): Spe			
	Bioprocess Engineering: Core qualification: Elective Compulsory	, , ,	, ,	
	General Engineering Science (English program): Specialisation P	rocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation B			
	General Engineering Science (English program, 7 semester): Spe	cialisation Process Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester): Spe			
	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	



Course L0835: Physical Chemistry	
	Laborator Occurre
Тур	Laboratory Course
Hrs/wk	2
CP Wasklaad in Usure]
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Hans-Ulrich Moritz, Dr. Werner Pauer
Language	
Cycle	
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



Module M0536: Fundamen	als of Fluid Mechanics			
Courses				
Fitle		Тур	Hrs/wk	CP
Fundamentals of Fluid Mechanics (L0091) Fluid Mechanics for Process Engineering		Lecture Recitation Section (large)	2	4
Module Responsible	Prof. Michael Schlüter	neoliaion occion (large)	L	L
Admission Requirements	None			
Recommended Previous Knowledge	Mathematics I+II+III			
Kilowiedge	Technical Mechanics I+II			
	 Technical Thermodynamics I+II 			
	Working with force balances			
	 Simplification and solving of partial differential equations 			
	Integration			
Educational Objectives	After taking part successfully, students have reached the following learn	ing results		
Professional Competence	The raing part becobering, sacone have reached the leneting rear			
Knowledge	Students are able to:			
lanowicago				
	 explain the difference between different types of flow 			
	 give an overview for different applications of the Reynolds Trans 	port-Theorem in process enginee	ering	
	 explain simplifications of the Continuity- and Navier-Stokes-Equation 	ation by using physical boundary	conditions	
Skills	The students are able to			
entite entite				
	 describe and model incompressible flows mathematically 			
	 reduce the governing equations of fluid mechanics by simplificat 		ons e.g. by integration	
	 notice the dependency between theory and technical application 			
	 use the learned basics for fluid dynamical applications in fields of 	f process engineering		
Personal Competence				
Social Competence	The students			
,				
	 are capable to gather information from subject related, profession 			
	 able to work together on subject related tasks in small groups. The subject related tasks in small groups. 	hey are able to present their resu	Its effectively in English	(e.g. during small gro
	exercises)			
	are able to work out solutions for exercises by themselves, to dis	cuss the solutions orally and to p	resent the results.	
Autonomy	The students are able to			
	search further literature for each topic and to expand their knowledge			
	work on their exercises by their own and to evaluate their 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 Proces	s Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Biopro	0 0 1 ,		
	General Engineering Science (German program): Specialisation Energy	and Enviromental Engineering:	Compulsory	
	General Engineering Science (German program, 7 semester): Specialis	ation Process Engineering: Com	oulsory	
	General Engineering Science (German program, 7 semester): Specialis	ation Bioprocess Engineering: Co	ompulsory	
	General Engineering Science (German program, 7 semester): Specialis	ation Energy and Enviromental E	ngineering: Compulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compulsory	1		
	General Engineering Science (English program): Specialisation Bioproc	cess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Energy	and Enviromental Engineering: (Compulsory	
	General Engineering Science (English program): Specialisation Process	s Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisa	ation Process Engineering: Comp	oulsory	
	General Engineering Science (English program, 7 semester): Specialisa	ation Bioprocess Engineering: Co	mpulsory	
	General Engineering Science (English program, 7 semester): Specialisa	ation Energy and Enviromental Er	ngineering: Compulsory	
	Technomathematics: Specialisation III. Engineering Science: Elective Co	ompulsory		
	Process Engineering: Core qualification: Compulsory			



Course L0091: Fundamentals of Flui	d 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 Gmbł Wiesbaden, 2008
	 Kuhlmann, H.C.: Strömungsmechanik. München, Pearson Studium, 2007 Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GW 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

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.



Module M0757: Biochemist	ry and Microbiology			
Courses				
Title		Тур	Hrs/wk	CP
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 reached th	e following learning results		
Professional Competence				
Knowledge	At the end of this module the students can:			
	- explain the methods of biological and biochemical research to determine the properties of biomolecules			
- name the basic components of a living organism				
	- explain the principles of metabolism			
	- describe the structure of living cells			
	-			
Skills				
Personal Competence				
Social Competence	The students are able,			
	- to gather knowledge in groups of about 10 students			
	- to introduce their own knowledge and to argue their vi	ew in discussions in teams		
	- to divide a complex task into subtasks, solve these and	d to present the combined results		
Autonomy	The students are able to present the results of their sub	tasks in a written report		
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): Spec	ialisation Bioprocess Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 sem	ester): Specialisation Bioprocess Engineering: Cor	npulsory	
	Bioprocess Engineering: Core qualification: Compulsor	у		
	General Engineering Science (English program): Spec	alisation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program, 7 sem	ester): Specialisation Bioprocess Engineering: Corr	pulsory	
	Technomathematics: Specialisation III. Engineering Sci	ence: Elective Compulsory		



Course L0351: Biochemistry	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
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:
	7. 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 L0728: Biochemistry	

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	See interlocking course
Literature	See interlocking course



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	 The procaryotic cell evolution taxonomy and specific properties of Archaea, Bacteria, and viruses structure and properties of the cell growth Metabolism fermentation and anaerobic respiration methanogenesis and the anaerobic food chain degradation of polymers chemolithotrophy Microorganisms in relation to the environment chemotaxis and motility Elemental cycle of carbon, nitrogen and sulfur biofilms symbiotic relationships extremophiles biotechnology
Litorohuro	
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	

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	See interlocking course
Literature	See interlocking course



Courses				
Title		Тур	Hrs/wk	CP
Thermodynamics III (L0114)		Lecture	2	2
Thermodynamics III (L0140)		Recitation Section (small)	1	2
Thermodynamics III (L0142)		Recitation Section (large)	1	2
Module Responsible	Prof. Irina Smirnova			
Admission Requirements	None			
Recommended Previous	Mathematics, Physical Chemistry, Thermodynamics I and I	1		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the for	Illowing learning results		
Professional Competence				
Knowledge	 Starting from the very basics of thermodynamics, th 	e students learn the mathematical tools to descr	ibe thermodynamic eq	quilibria.
	They learn how state variables are influenced by th	e mixing of compounds and learn concepts to q	uantitatively describe	these properties.
	Moreover, the students learn how phase equilibria	can be described mathematically and which ph	enomena may occur i	f different phases (vap
	liquid, solid) coexist in equilibrium. Furthermore the	fundamentals of reaction equilibria are taught.		
	 For different phase equilibria, several examples rel 	evant for different kinds of processes are shown	and the necessary ki	nowledge for plotting a
	interpreting the equilibria are taught.			
Skills				
	Applying their knowledge, the students are able to identify the correct equation for the determination of the equilibrium state and know how			
	simplify these equations meaningfully.The students know models which can be used to determine the properties of the system in the equilibrium state and they are able to solve t			
		determine the properties of the system in the e	quilibrium state and ti	ney are able to solve
	resulting mathematical relations.			
	 For specific applications, they are able to self-relian literature sources. 	niy ind necessary physico-chemical properties	or compounds as wer	i as model parameters
	 Beside pure compound properties the students are 	capable of describing the properties of mixtures		
	 The students know how to visualize phase equilibri 			2
	 Based on their knowledge, the students are able 			
	processes in chemical engineering.	to understand undamental concepts that are	the basis for many	separation and react
	processes in chemical engineering.			
Personal Competence				
Social Competence	The students are able to work in small groups, to solve the	corresponding problems and to present them o	raly to the tutors and c	ther students
	The students are able to work in small groups, to solve the	corresponding problems and to present them of		
Autonomy	The students are able to find necessary information	ary information self-reliantly in literature sources and to judge their quality.		
	During the semester the students are able to check	their learning progress continuously in exercis	es. Based on this kno	wledge the students of
	adept their learning process.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination Examination duration and scale	Written exam 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			
Gurricula	General Engineering Science (German program, 7 semest		ulsory	
	General Engineering Science (German program, 7 semest			
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialis	sation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialis			
	General Engineering Science (English program, 7 semesti		Ilsorv	
	General Engineering Science (English program, 7 semesti General Engineering Science (English program, 7 semesti			



Course L0114: Thermodynamics III	
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	
	 Introduction: Applications of thermodynamics of mixtures Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule Equations of state: virial equations, van-der-Waals equation, generalized equations of state Mixing properties: ideal and real mixtures, excess properties, partial molar properties Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition Gas-liquid-equilibria: equilibrium condition, Henry-coefficient G^E-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems Solid-liquid-equilibria: equilibrium condition, binary systems Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature 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.

<i>,</i> ,	Recitation Section (small)
Hre/wk	necitation Section (smail)
TII 5/WK	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	SoSe
Literature	 Introduction: Applications of thermodynamics of mixtures Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule Equations of state: virial equations, van-der-Waals equation, generalized equations of state Mixing properties: ideal and real mixtures, excess properties, partial molar properties Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition Gas-liquid-equilibria: equilibrium condition, Henry-coefficient Q^E-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems Solid-liquid-equilibria: equilibrium condition, binary systems Solid-liquid-equilibria: equilibrium condition, binary systems Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature Osmotic pressure The students work on tasks in small groups and present their results in front of all students. 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: Thermodynamics III	
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	 Introduction: Applications of thermodynamics of mixtures Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule Equations of state: virial equations, van-der-Waals equation, generalized equations of state Mixing properties: ideal and real mixtures, excess properties, partial molar properties Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition Gas-liquid-equilibria: equilibrium condition, Henry-coefficient G^E-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems Solid-liquid-equilibria: equilibrium condition, binary systems Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature 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: Thermodynamic Cambridge University Press, 2005.



Nodule M0672: Signals and	d Systems		
Courses			
ïtle	Typ Hrs	s/wk	CP
ignals and Systems (L0432)	Lecture 3		4
ignals and Systems (L0433)	Recitation Section (large) 1		2
Module Responsible	Prof. Gerhard Bauch		
Admission Requirements	None		
Recommended Previous			
Knowledge	The modul is an introduction to the theory of signals and systems. Good knowledge in maths as covered by the m	oduls Mather	natik 1-3 is expec
	Further experience with spectral transformations (Fourier series, Fourier transform, Laplace transform) is useful but no	t required.	
Educational Ohiosticae			
Educational Objectives Professional Competence			
Knowledge		al and system	theory They are a
Khowledge	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describ		
	and systems mathematically in both time and image domain. In particular, they understand the effects in time don		
	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	s of signal and	d system theory. T
	can analyse and design basic systems regarding important properties such as magnitude and phase response, stab	vility, linearity	etc They can ass
	the impact of LTI systems on the signal properties in time and frequency domain.		
Personal Competence			
Social Competence			
Autonomy		el of knowled	lge during the lec
	period by solving tutorial problems, software tools, clicker system.		
Workload in Hours			
Credit points			
Examination			
Examination duration and scale			
Assignment for the Following			
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 Process Engineering: Computering Computering		
	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 Biomecl		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft		
	General Engineering Science (German program, 7 semister): Specialisation Mechanical Engineering, Focus M		
	Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatr	ronics: Compi	ulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus The	eoretical Mec	chanical Engineer
	Compulsory		
	Computer Science: Core qualification: Compulsory		
	Electrical Engineering: Core qualification: 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 Computer Science: Compulsory		
	General Engineering Science (English program): Specialisation Computer Science: Computery 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 Biomech		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy S		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft S General Engineering Science (English program, 7 semester): Specialisation, Mechanical Engineering, Focus M		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus M Compulsory	ateriais in El	ngineeinig Scien
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro	onics: Compu	Ilsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus The		
			3
	Compulsory		
	Compulsory Computational Science and Engineering: Core qualification: Compulsory		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	
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	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	
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



ourses				
tle		Тур	Hrs/wk	CP
roduction to Management (L0880) oject Entrepreneurship (L0882)		Lecture Problem-based Learning	3	3 3
Module Responsible	Prof. Christoph Ihl	Frobletti-based Learning	2	3
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the foll	owing learning results		
Professional Competence				
Knowledge	After taking this module, students know the important basic Marketing and Innovation, and also to Investment and Contr		nagement, from Plan	ning and Organisatior
	 explain the differences between Economics and Mar field of Management explain the most important aspects of and goals in M describe and explain basic business functions as p ressource management, information management, ir explain the relevance of planning and decision ma some basic methods from mathematical Finance 	anagement and name the most important aspe roduction, procurement and sourcing, supply novation management and marketing	ects of entreprneurial chain management,	projects organization and hurr
	 state basics from accounting and costing and selected 	ed controlling methods.		
Skills	Students are able to analyse business units with resp Entrepreneurship project in a team. In particular, they are ab		ctives, strategies etc	.) and to carry out
	 analyse Management goals and structure them appr analyse organisational and staff structures of compar apply methods for decision making under multiple ob analyse production and procurement systems and Br analyse and apply basic methods of marketing select and apply basic methods from mathematical fi apply basic methods from accounting, costing and co 	nies ojectives, under uncertainty and under risk usiness information systems nance 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 entrep to communicate appropriately and 	preneurship project and write a coherent 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 Minuten			
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		ompulsory	
	General Engineering Science (German program): Specialisa	с, с с	1	
	General Engineering Science (German program): Specialisa	ation Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisa	ation Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste		-	
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste			у
	General Engineering Science (German program, 7 semeste General Engineering Science (German program, 7 semeste General Engineering Science (German program, 7 semeste General Engineering Science (German program, 7 semeste	r): Specialisation Mechanical Engineering, Foo r): Specialisation Mechanical Engineering, Foo r): Specialisation Mechanical Engineering, Foo	cus Mechatronics: Cor cus Biomechanics: Co cus Aircraft Systems E	npulsory mpulsory ngineering: Compulso
	Compulsory			



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
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 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 Energy and Enviromental 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 Enviromental 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: 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
,,	3
	3
	Independent Study Time 48, Study Time in Lecture 42
	Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgar
	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
0 0	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 Manageme 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
19	
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.	



Courses				
Title		Тур	Hrs/wk	CP
Bioprocess Engineering - Fundamentals (I	(0841)	Lecture	2	3
Bioprocess Engineering- Fundamentals (L		Recitation Section (large)	2	1
Bioprocess Engineering - Fundamental Pra		Laboratory Course	2	2
Module Responsible	Prof. Andreas Liese			
Admission Requirements	none			
Recommended Previous	none, module "organic chemistry", module "fundamentals for pro	cess engineering"		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the followin	g learning results		
Professional Competence				
Knowledge	Students are able to describe the basic concepts of bioproce	ss engineering. They are able to classif	y different types of	kinetics for enzymes a
	microorganisms, as well as to differentiate different types of inhil			
	processes in bioreactors can be explained. The students are			
	downstream processing in detail.			
Skills	After successful completion of this module, students should be al	ble to		
	 describe different kinetic approaches for growth and subs 	strate-uptake and to calculate the correspo	nding parameters	
	 predict qualitatively the influence of energy generation, re 		• ·	ermentation process
	 analyze bioprocesses on basis of stoichiometry and to se 			
	 distinguish between scale-up criteria for different bioreac 		c as well as microae	robic) to compare them
	well as to apply them to current biotechnical problem			
	 propose solutions to complicated biotechnological problem 	ams and to deduce the corresponding mod	lels	
		and to deduce the corresponding mee		
	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 result 	Ilts in a scientific manner		
Personal Competence				
Social Competence	After completion of this module participants should be able to d	ebate technical questions in small teams	to enhance the abil	ty to take position to th
	own opinions and increase their capacity for teamwork in engine	ering and scientific environments.		
Autonomy		ve a technical problem in a team indepe	endently by organizi	ng their workflow and
	present their results in a plenum.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points				
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Process Engineering: Compulsory		
Curricula				
	General Engineering Science (German program, 7 semester): Sp		ulsory	
	General Engineering Science (German program, 7 semester): Sp			
	Bioprocess Engineering: Core qualification: Compulsory		, ,	
	General Engineering Science (English program): Specialisation	Bioprocess Engineering: Compulsory		
		Process Engineering: Compulsory		
	General Engineering Science (English program): Specialisation		lsorv	
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp	ecialisation Process Engineering: Compu		
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp	ecialisation Process Engineering: Compu ecialisation Bioprocess Engineering: Com		
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp Biomedical Engineering: Specialisation Artificial Organs and Reg	ecialisation Process Engineering: Compu ecialisation Bioprocess Engineering: Com generative Medicine: Compulsory		
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp Biomedical Engineering: Specialisation Artificial Organs and Reg Biomedical Engineering: Specialisation Implants and Endoprost	ecialisation Process Engineering: Compu ecialisation Bioprocess Engineering: Com generative Medicine: Compulsory heses: Elective Compulsory		
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp Biomedical Engineering: Specialisation Artificial Organs and Reg Biomedical Engineering: Specialisation Implants and Endoprost Biomedical Engineering: Specialisation Medical Technology and	ecialisation Process Engineering: Compu ecialisation Bioprocess Engineering: Com generative Medicine: Compulsory heses: Elective Compulsory d Control Theory: Elective Compulsory		
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp Biomedical Engineering: Specialisation Artificial Organs and Reg Biomedical Engineering: Specialisation Implants and Endoprost	ecialisation Process Engineering: Compu ecialisation Bioprocess Engineering: Com generative Medicine: Compulsory neses: Elective Compulsory d Control Theory: Elective Compulsory ess Administration: Elective Compulsory		



Course L0841: Bioprocess Enginee	ring - Fundamentals
	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	
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	



Madula M0500, Up at and M				
Module M0538: Heat and M	lass i ranster			
Courses				
litle		Тур	Hrs/wk	CP
Heat and Mass Transfer (L0101) Heat and Mass Transfer (L0102)		Lecture Recitation Section (small)	2	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 following I	learning results		
Professional Competence				
Knowledge	 The students are capable of explaining qualitative and do chemical reactors). They are capable of distinguish and characterize different la radiation. The students have the ability to explain the physical basis for using suitable mass transfer theories. They are able to depict the analogy between heat- and mass 	kinds of heat transfer mechanisms name	ely heat conduction, l e mass transfer quali	neat transfer and therr
Skills	 The students are able to set reasonable system boundarie corresponding energy and mass flow, respectively. They are capable to solve specific heat transfer problems corresponding heat flows. Using dimensionless quantities, the students can execute so They are able to distinguish between diffusion, convective and design of apparatus (e.g. extraction column, rectification) In this context, the students are capable to choose and considering their advantages and disadvantages, respectiv. In addition, they can calculate both, steady-state and non-st The students are capable to connect their knowledge or thermodynamics, fluid mechanics and chemical process end 	(e.g. heated chemical reactors, temper caling up of technical processes or appa mass transition and mass transfer. The n column). design fundamental types of heat an ely. teady-state processes in procedural app btained in this course with knowlegd	ature alteration in flu aratus. ey can use this know d mass exchanger f aratus. e of other courses (ids) and to calculate to ledge for the description or a specific application
Personal Competence Social Competence	 The students are capable to work on subject-specific challe other students. 	enges in teams and to present the resul	ts orally in a reasona	ble manner to tutors a
Autonomy	 The students are able to find and evaluate necessary inform They are able to prove their level of knowledge during assignments) and on this basis they can control their learning 	the course with accompanying proce	dure continuously (c	slicker-system, exam-l
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): Specialisation Pr			
Curricula	General Engineering Science (German program): Specialisation Bi			
	General Engineering Science (German program): Specialisation En			
	General Engineering Science (German program, 7 semester): Spec	÷ • ·		
	General Engineering Science (German program, 7 semester): Spec			
	General Engineering Science (German program, 7 semester): Spec	claiisation Energy and Enviromental Eng	gineering: Compulsoi	у
	Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compu	ilsory		
	General Engineering Science (English program): Specialisation Bio	•		
	General Engineering Science (English program): Specialisation Bit General Engineering Science (English program): Specialisation En		mpulsory	
	General Engineering Science (English program): Specialisation En General Engineering Science (English program): Specialisation Pr			
		constructing. Compulsory		
		cialisation Process Engineering: Comput	sorv	
	General Engineering Science (English program, 7 semester): Spec		-	
		cialisation Bioprocess Engineering: Com	pulsory	y
	General Engineering Science (English program, 7 semester): Spec General Engineering Science (English program, 7 semester): Spec	sialisation Bioprocess Engineering: Com sialisation Energy and Enviromental Eng	pulsory	у
	General Engineering Science (English program, 7 semester): Spec General Engineering Science (English program, 7 semester): Spec General Engineering Science (English program, 7 semester): Spec	sialisation Bioprocess Engineering: Com sialisation Energy and Enviromental Eng	pulsory	y



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	 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

Course 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	paration Processes			
Courses				
ïtle		Тур	Hrs/wk	CP
hermal Separation Processes (L0118)		Lecture	2	2
hermal Separation Processes (L0119)		Recitation Section (small)	2	2
hermal 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 follow	ving learning results		
Professional Competence				
Knowledge	 The students can distinguish and describe different typ. The students develop an understanding for the course process, the possibilities of energy saving, and the sele They have good knowledge of designing methods for s 	e of concentration during a separation proce action 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 required They can select and design a basic type of thermal separation process for a given case based on the advantages and disadvantages of th 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. 			
Personal Competence Social Competence	The students can work technical assignments in small			
	 The students are able to carry out practical lab work in discuss their results and to document them scientifically 		ision of labor betwee	en them. They are able
Autonomy	 The students are capable to obtain the needed informa The students can proof the state of their knowledge with 	•		
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): Specialisatio	on Process Engineering: Compulsory		
Assignment for the Pollowing Curricula				
Curricula	General Engineering Science (German program): Specialisatio		ampulaan	
	General Engineering Science (German program): Specialisatio			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):	Specialisation Bioprocess Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semester):	Specialisation Energy and Enviromental Eng	gineering: Compulso	ry
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Co	ompulsorv		
	Energy and Environmental Engineering: Core qualification: Co			
	General Engineering Science (English program): Specialisation	on Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisatic General Engineering Science (English program): Specialisatic	on Bioprocess Engineering: Compulsory on Energy and Enviromental Engineering: Co	ompulsory	
	General Engineering Science (English program): Specialisatic General Engineering Science (English program): Specialisatic General Engineering Science (English program): Specialisatic	on Bioprocess Engineering: Compulsory on Energy and Enviromental Engineering: Co on Process Engineering: Compulsory		
	General Engineering Science (English program): Specialisatic General Engineering Science (English program): Specialisatic	on Bioprocess Engineering: Compulsory on Energy and Enviromental Engineering: Co on Process Engineering: Compulsory		
	General Engineering Science (English program): Specialisatic General Engineering Science (English program): Specialisatic General Engineering Science (English program): Specialisatic	on Bioprocess Engineering: Compulsory on Energy and Enviromental Engineering: Co on Process Engineering: Compulsory Specialisation Process Engineering: Compu	lsory	
	General Engineering Science (English program): Specialisatic General Engineering Science (English program): Specialisatic General Engineering Science (English program): Specialisatic General Engineering Science (English program, 7 semester):	on Bioprocess Engineering: Compulsory on Energy and Enviromental Engineering: Co on Process Engineering: Compulsory Specialisation Process Engineering: Compu Specialisation Bioprocess Engineering: Com	lsory	у



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	 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



Course L0119: Thermal Separation	
	Recitation Section (small)
Hrs/wk	
CP	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	 The students work on tasks in small groups and present their results in front of all students. 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



Course L0141: Thermal Separation Typ	Recitation Section (large)
Hrs/wk	
	1
CP	
	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 Selection 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. 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



Course L1159: Separation Process	28
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 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.
	 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 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. Steinkopt 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				
ïtle		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 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, physic	al chemistry, technical thermodynamics I+II as w	ell as computational r	methods for engineers
Knowledge				
Educational Objectives	After taking part successfully, students have reached the for	llowing learning results		
Professional Competence				
Knowledge	The students are able to explain basic concepts of chemic	al reaction engineering. They are able to point	out differences betwe	en thermodynamical a
	kinetical processes. The students have a strong ability to o	utline parts of isothermal and non-isothermal ide	eal reactors and to de	scribe their properties.
Skills	After successful completion of the module, students are ab	le to:		
	- apply different computational methods to dimension isoth	ermal and non-isothermal ideal reactors,		
	- determine and compute stable operation points for these	reactors ,		
	- conduct experiments on a lab-scale pilot plants and docu	ment these according to scientific guidelines.		
Personal Competence				
Social Competence	After successful completition of the lab-course the studen	nts have a strong ability to organize themselfe	s in small groups to	solve issues in chemi
	reaction engineering. The students can discuss their subje	ect related knowledge among each other and wit	h their teachers.	
Autonomy	The students are able to obtain further information and a	ussess their relevance autonomously. Students	can apply their know	Idege discretely to pla
	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): Speciali	sation Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Speciali			
	General Engineering Science (German program, 7 semes		ulsory	
	General Engineering Science (German program, 7 semes	, , , , , , , , , , , , , , , , , , , ,		
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialis	sation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialis			
	General Engineering Science (English program), Special		Ilsory	
	General Engineering Science (English program, 7 semest			
	Process Engineering: Core qualification: Compulsory			
	rissess Engineering. One quanication. 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, inert 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, chemica equilibrium, activity, van't Hoff law, calculation of chemical equilibrium, principle of Le Chatelier and Braun, equilibrium calculations in multiple reactio 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 integra 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, rat limiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of comple 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
	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



ourse L0244: Chemical Reaction I	
	Recitation Section (large)
Hrs/wk	
CP Workload in Hours	2 Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Raimund Horn, Dr. Oliver Korup
Language	DE
Cycle	WiSe
Content	and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentration, ma concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, conversis 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, relati 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, standar 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, chemic 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, macrokinetics, 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, re limiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of comp kinetics)
	Types of chemical Reaktors (chemical reactors in industry and laboratory, ideal vs. real reaktors, discontinuous, half continuous and continuous reactor single phase - biphasic- and multiphase reactors, batch-reactor, semi-batch reactor, CSTR, Plug Flow reactor, fixed bed reactor, adiabatic stag 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 varial kinetics, partial fraction decomposition, mole balance of the semi-batch reactor, mole balance of the plug flow reactor, analogy batch reactor - plug flor reactor, design of plug flow reactors for reactions with volume change and complex reactions, mole balance of a fixed bed reactor, design or 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 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
	A. Jess, P. Wasserscheid, Chemical Technology An Integrated Textbook, WILEY-VCH



Typ I Hrs/wk 2	Laboratory Course
Hrs/wk 2	
	2
CP 2	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)
1	Praktikumsskript
	Skript Chemische Verfahrenstechnik 1 (F.Keil)



Courses				
Title		Typ	Hrs/wk	CP
Rioprocess Engineering - Advanced (L110	17)	Typ Lecture	2	4
Bioprocess 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				
Educational Objectives	After taking part successfully, students have reached the follo	wing learning results		
Professional Competence				
Knowledge	After successful completion of this module, students should be	e able to		
	 describe and explain different kinetic approaches for g 	rowth 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 n	nethods
Skills	After successful completion of this module, students should be	e able to		
	- to identifiy scientific questions or possible practical probler	ns for concrete industrial applications (eg cu	tivation of microorga	nisms and animal cel
	and to formulate solutions,			
	- To assess the application of scale-up criteria for different typ	bes of bioreactors and processes and to appl	y these criteria to giv	en problems (anaerob
	aerobic or microaerobically)			
	to formulate questions for the analysis and entimization of ra		roprioto colutiono	
	- to formulate questions for the analysis and optimization of re	al biotechnological production processes app	ropriate solutions,	
	- To describe the effects of the energy generation, the regene	ration of reduction equivalents , and the grow	h inhibition of the be	havior of microorganis
	and to the total fermentation process qualitatively			
	- Establish material flow balance equations and solve them t	o determine the kinetic parameters of differen	t approaches and to	calculate immobilizat
	and activity yields ,			
	- to select process control strategies (batch , fed-batch , contir	uity) appropriately and to calculate basic typ	es and evaluate ther	n.
Personal Competence				
Social Competence	After completion of this module participants should be able t	o debate technical questions in small teams	to enhance the abili	ty to take position to th
	own opinions and increase their capacity for teamwork.			
Autonomy	After completion of this module participants are able to aquin	e new sources of knowledge and apply their	knowledge to previor	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			
Assignment for the Following	General Engineering Science (German program): Specialisat	ion Bioprocess Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester)	Specialisation Bioprocess Engineering: Con	npulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program, 7 semester):	opecialisation Bioprocess Engineering: Com	puisory	
	Technomathematics: Core qualification: Elective Compulsory Technomathematics: Specialisation III. Engineering Science:	Elective Compulsory		
	recimomathematics. 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



Courses Typ Hrs/wk CP Process and Plant Engineering I (L0095) Lecture 2 2 Process and Plant Engineering I (L0095) Recitation Section (large) 1 2 Process and Plant Engineering I (L0121) Recitation Section (small) 1 2 Module Responsible Prof. Georg Fieg 1 2 Admission Requirements none	
Title Typ 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 (L0096) Prof. Georg Fieg 1 2 Module Responsible Porf. Georg Fieg none	
Process and Plant Engineering I (L0995) Lecture 2 2 Process and Plant Engineering I (L0996) Recitation Section (large) 1 2 Process and Plant Engineering I (L1214) Recitation Section (small) 1 2 Module Responsible Prof. Georg Fleg Recitation Section (small) 1 2 Admission Requirements none Init operation of thermal an dmechanical separation processes chemical reactor eingineering Init operation of thermal and mechanical separation processes Init operation of thermal and mechanical separation processes Init operation of thermal and mechanical separation processes Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the collowing learning results Init operation of thermal and the c	
Process and Plant Engineering 1 (L0096) Recitation Section (large) 1 2 Process and Plant Engineering 1 (L1214) Recitation Section (small) 1 2 Module Responsible Prof. Georg Fieg Admission Requirements none Recommended Previous unit operation of thermal an dmechanical separation processes Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge students can: <td></td>	
Process and Plant Engineering 1 (1212) Recitation Section (small) 1 2 Module Responsible Prof. Georg Fieg Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and mechanical separation processes Image: Comparison of the rmal and the reconcilitation processes Image: Comparison of the rmal and the reconcilitation problems Image: Comparison of the rmal and the reconcilitation problems Image: Comparison of the rmal and the reconcilitation problems Image: Comparison of the rmal and the reconcilitation problems Image: Comparison of the rmal and the reconcilitation problems Image: Comparison of the rmal and the reconcilitation problems Image: Comparison of the rmal and the reconcilitation problems Image: Comparison of the rmal and the reconcilitation problems Image: Comparison of the rmal and the reconcilitation problems Image: Comparison of the rmal and the reconcili	
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 Knowledge students can: classify and formulate blobal balance equations of chemical processes specify linear component equations of complex chemical processes explain linear regression and data reconcilliation problems explain pfd-diagrams students are capable of	
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 Knowledge students can: classify and formulate blobal balance equations of chemical processes specify linear component equations of complex chemical processes explain linear regression and data reconcilliation problems explain pfd-diagrams Skills students are capable of	
Knowledge After taking part successfully, students have reached the following learning results Professional Competence knowledge Knowledge students can: classify and formulate blobal balance equations of chemical processes specify linear component equations of complex chemical processes explain linear regression and data reconcilliation problems explain pfd-diagrams skills students are capable of	
Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence students can: Classify and formulate blobal balance equations of chemical processes specify linear component equations of complex chemical processes explain linear regression and data reconcilliation problems explain pfd-diagrams Skills students are capable of	
Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence students can: Knowledge students can: classify and formulate blobal balance equations of chemical processes specify linear component equations of complex chemical processes explain linear regression and data reconcilliation problems explain pfd-diagrams Skills students are capable of	
Professional Competence students can: Knowledge students can: classify and formulate blobal balance equations of chemical processes specify linear component equations of complex chemical processes explain linear regression and data reconcilliation problems explain pfd-diagrams Skills students are capable of	
Knowledge students can: classify and formulate blobal balance equations of chemical processes specify linear component equations of complex chemical processes explain linear regression and data reconcilliation problems explain pfd-diagrams Skills	
classify and formulate blobal balance equations of chemical processes specify linear component equations of complex chemical processes explain linear regression and data reconcilliation problems explain pfd-diagrams Skills	
specify linear component equations of complex chemical processes explain linear regression and data reconcilliation problems explain pfd-diagrams Skills students are capable of	
explain linear regression and data reconcilliation problems explain pfd-diagrams <i>Skills</i> students are capable of	
explain pfd-diagrams <i>Skills</i> students are capable of	
Skills students are capable of	
- formulation of mass and energy balance equations and estimation of product strooms	
- ionnulation of mass and energy balance equations and estimation 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 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): Specialisation Process Engineering: Compulsory	
General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Elective Compulsory	
Bioprocess Engineering: Core qualification: Compulsory	
General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory	
General Engineering Science (English program): Specialisation Process Engineering: 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 Energy and Enviromental Engineering: Elective Compulsory	
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	 Introduction Structure and operation of production plants Operational business process Technical process design Motivation and targets of process development Life cycle of production plants 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 (German program)"

chnische	 	

	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
	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
L	

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 Teo	chnology and Solids Process Engineering			
Courses				
Title		Тур	Hrs/wk	CP
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	earning results		
Professional Competence				
Knowledge	After successful completion of the module students are able to			
	 name and explain processes and unit-operations of solids 	process engineering		
	 characterize particles, particle distributions and to discuss the 	0		
Skills	Students are able to			
	 choose and design apparatuses and processes for solids p 		ds properties of the pro	duct
	 asses solids with respect to their behavior in solids process 	ing 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 solid p	articles 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 P	ocess Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation B	oprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation E			
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): Spe	cialisation Energy and Enviromental Er	igineering: Compulsor	/
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compu	•		
	General Engineering Science (English program): Specialisation Bi			
	General Engineering Science (English program): Specialisation Er		ompulsory	
	General Engineering Science (English program): Specialisation Pr		loon	
	General Engineering Science (English program, 7 semester): Spec	• • •		
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): Spec	ansation Energy and Enviromental En	gineering: Compulsory	
	Process Engineering: Core qualification: Compulsory			



Course L0434: Particle Technology	
Тур	
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 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	1
	Laboratory Course
Hrs/wk	
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
	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.

z



Specialization Electrical Engineering

Module M0708: Electrical E	ngineering III: Circuit Theory and Transients			
•				
Courses				
Title		Тур	Hrs/wk	CP
Circuit Theory (L0566) Circuit Theory (L0567)		Lecture Recitation Section (small)	3 2	4
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 follow	ing learning results		
Professional Competence				
Knowledge	Students are able to explain the basic methods for calculatin			
	periodic signals. They know the methods for transient analys frequency behaviour and the synthesis of passive two-terminal		ency domain, and they	are able to explain the
	inequency behaviour and the synthesis of passive two-terminal	-circuits.		
Skills	The students are able to calculate currents and voltages in lin	ear networks by means of basic methods	also when driven by p	ariodic signals. They are
OKIIS	able to calculate transients in electrical circuits in time and freq	•		
	analyse and to synthesize the frequency behaviour of passive			aviour. moy are able a
Personal Competence				
Social Competence	Students work on exercise tasks in small guided groups. They	are encouraged to present and discuss the	ir results within the gro	up.
A	The students are able to find out the required methods for call	ing the since greating much land. Descibilit		in her state show the state
Autonomy	The students are able to find out the required methods for solv			
	lectures continuously by means of short-time tests. This allow knowledge to other courses like Electrical Engineering I and M		icational objectives. In	ey can link their gamed
	knowledge to other courses like Electrical Engineering Fand w			
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): Specialisatio			
Curricula	General Engineering Science (German program): Specialisatio			
	General Engineering Science (German program, 7 semester):			npulsory
	General Engineering Science (German program, 7 semester): Electrical Engineering: Core qualification: Compulsory	opeoralisation Electrical Engineering: Com	ipuisory	
	General Engineering Science (English program): Specialisatio	n Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisatio		onics: Compulsory	
	General Engineering Science (English program, 7 semester): S			pulsory
	General Engineering Science (English program, 7 semester): S	0 0		
	Computational Science and Engineering: Specialisation Engin			
	Mechatronics: Core qualification: Compulsory	-		
1				
	Technomathematics: Specialisation III. Engineering Science: E	lective Compulsory		

Module Manual B. Sc. "General Engineering Science (German program)"



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	ourse L0567: Circuit Theory	
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	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	



Courses				
Title		Тур	Hrs/wk	CP
Theoretical Electrical Engineering I: Time-	Independent Fields (L0180)	Lecture	3	5
Theoretical Electrical Engineering I: Time-	Independent Fields (L0181)	Recitation Section (small)	2	1
Module Responsible	Prof. Christian Schuster			
Admission Requirements	Elektrotechnik I, Elektrotechnik II, Mathematik I, Mathemati	k II, Mathematik III		
Recommended Previous	Basic principles of electrical engineering and advanced m	athematics		
Knowledge	basic principles of electrical engineering and advanced in	lationatics		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the for	plowing learning results		
Professional Competence	· ····· · ····························			
Knowledge	Students can explain the fundamental formulas, relations,	and methods of the theory of time-independent	electromagnetic field	s. They can explicate t
	principal behavior of electrostatic, magnetostatic, and co		-	
	complex electromagnetic fields by means of superpositio			
	independent electromagnetic fields and are able to explication			
Skills	Students can apply Maxwell's Equations in integral nota	ation in order to solve highly symmetrical, time	independent, electro	magnetic field probler
	Furthermore, they are capable of applying a variety of me	ethods that require solving Maxwell's Equations	for more general pro	blems. The students of
	assess the principal effects of given time-independent sou	urces of fields and analyze these quantitatively.	They can deduce mea	aningful quantities for t
	characterization of electrostatic, magnetostatic, and electrostatic	rical flow fields (capacitances, inductances, resi	stances, etc.) from giv	ven fields and dimens
	them for practical applications.			
D				
Personal Competence				
Social Competence	Students are able to work together on subject related to	asks in small groups. They are able to presen	t their results effective	ely (e.g. during exerc
	sessions).			
Autonomy	Students are capable to gather necessary information fro	on provided references and relate this informati	on to the lecture. The	av are able to continua
hatonomy	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 betwee			
	their knowledge obtained in this lecture and the content of			
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): Special			
Curricula	General Engineering Science (German program, 7 semes	ter): Specialisation Electrical Engineering: Comp	oulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Speciali			
	General Engineering Science (English program, 7 semest		ulsory	
	Technomathematics: Specialisation III. Engineering Scien	ce: Elective Compulsory		



Course L0180: Theoretical Electrica	I Engineering I: Time-Independent Fields
Тур	Lecture
Hrs/wk	
CP	
Workload in Hours	Independent Study Time 108, Study Time in Lecture 42
Lecturer	Prof. Christian Schuster
Language Cycle	DE 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 Electrica	al Engineering I: Time-Independent Fields
	Recitation Section (small)
Hrs/wk	
CP	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Christian Schuster
Language	
Cycle	SoSe - Maxwell's Equations in integral and differential notation
Content	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)



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 (Probler	n 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	d the following learning results		
Professional Competence				
Knowledge	Students can explain the composition and the struc	stural properties of materials used in electrical engine	eering. Students can e	explicate the relevance of
	mechanical, electrical, thermal, dielectric, magnetic a	and chemical properties of materials in view of their a	pplications in electrica	l engineering.
Skills	Students can identify appropriate descriptive models and apply them mathematically. They can derive approximative solutions and judge factors			
	influential on the performance of materials in electric	cal engineering applications.		
Personal Competence				
Social Competence	Students can jointly solve subject related problems course.	s in groups. They can present their results effective	ly within the framewor	k of the problem solvin
Autonomy		n from the provided references and to relate this info lp of lecture accompanying measures such as exan er 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): Sp	pecialisation Electrical Engineering: Compulsory		
Curricula		semester): Specialisation Electrical Engineering: Com	pulsory	
	Electrical Engineering: Core qualification: Compulso			
	General Engineering Science (English program): Sp			
		emester): Specialisation Electrical Engineering: Com	pulsory	
	Computational Science and Engineering: Specialisa			

Module Manual B. Sc. "General Engineering Science (German program)"



Course L0714: Electrotechnical Exp	eriments
Тур	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Wieland Hingst
Language	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	
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Manfred Eich
Language	DE SoSe
Cycle	
Content	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 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.HageIstein 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 Electric	al Engineering (Problem Solving Course)
Тур	Recitation Section (small)
Hrs/wk	
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)



ourses	
itle	Typ Hrs/wk CP
ignals and Systems (L0432)	Lecture 3 4
ignals and Systems (L0433)	Recitation Section (large) 1 2
Module Responsible	Prof. Gerhard Bauch
Admission Requirements	None
Recommended Previous	Mathematics 1-3
Knowledge	manonaus 15
rtionicage	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	Aller laking part successiony, sudents have reached the following rearning results
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
Skills	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse deterministic sig 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. 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	
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 lec
	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
ourround	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: Compute
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Scien 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 Enginee Compulsory
	Computer Science: Core qualification: Compulsory
	Electrical Engineering: Core qualification: 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 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 Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering, Computionly 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: Compuls
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Scien
	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 Enginee
	Compulsory
	Computational Science and Engineering: Core qualification: Compulsory Mechatronics: Core qualification: Compulsory



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems			
Typ Hrs/wk	2		
CP	4		
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42		
Lecturer	Prof. Gerhard Bauch		
Language	DE/EN		
Cycle	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		
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
Research Seminar Electrical Engineering,	Computer Science, Mathematics (L0571)	Seminar	2	2
Transmission Line Theory (L0570)		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 reache	d the following learning results		
Professional Competence				
Knowledge	Students can explain the fundamentals of wave pr	opagation on transmission lines at low and high fi	equencies. They are ab	le to analyze circuits w
	transmission lines in time and frequency domain.	They can describe simple equivalent circuits of tra	nsmission lines. They a	re able to solve proble
	with coupled transmission lines. They can present a	nd discuss a self-chosen research topic.		
Skills	Students can analyze and calculate the propagation of waves in simple circuits with transmission lines. They are able to analyze circuits in frequence			
	domain and with the Smith chart. They can anal			
	transmission lines using the vectorial transmission I			
	automosion mes using ne veolena automosion i		Sionais.	
Developed Commentance				
Personal Competence				
Social Competence	Students can analyze and solve problems in small groups and discuss their solutions. They can compare the learned theory with experiments in th lecture and discuss it in small groups. They are able to present a research topic to professionals and discuss it with them.			
	lecture and discuss it in small groups. They are able	to present a research topic to professionals and di	scuss 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 able to test their knowledge			
	using computer animations. They can test their leve		÷	
	acquired knowledge to other lectures (e.g. Electric	al Engineering I-III and Mathematics I-III). They car	familiarize themselves	with a research topic a
	can prepare a presentation.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture	34		
Credit points	6			
Examination	Written exam			
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): S	pecialisation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7	semester): Specialisation Electrical Engineering: C	ompulsory	
	Electrical Engineering: Core qualification: Compuls	ory		
	General Engineering Science (English program): S	pecialisation Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 s		ompulsory	
	Computational Science and Engineering: Specialis		-	
	Technomathematics: Specialisation III. Engineering	Science: Elective Compulsory		

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, Siavash Ahmadi Barogh	
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	



Courses				
Title		Тур	Hrs/wk	CP
Electrical Engineering Project Laboratory	(L0640)	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 part successfully, students have reached th	a following learning results		
Professional Competence	Alter taking part successiony, succents have reached in	e lonowing rearring results		
Knowledge	Students are able to give a summary of the technical d	etails of projects in the area of electrical enginee	ring and illustrate respe	ective relationships. Th
	are capable of describing and communicating relevan			
	process of solving practical problems and present relate	ed results.		
Skills	The students can transfer their fundamental knowled			
	overcome typical problems during the realization of pro conceptual solutions for non-standardized problems.	jects in the context of electrical engineering. Stud	dents are able to develo	p, compare, and choo
Personal Competence				
Social Competence	Students are able to cooperate in small, mixed-subject	t groups in order to independently derive solution	ons to given problems ir	n the context of electri
	engineering. They are able to effectively present and e			
	develop alternative approaches to an electrical enginee	ering problem independently or in groups and dis	cuss advantages as we	ll as drawbacks.
Autonomy	Students are capable of independently solving electric	al engineering problems using provided literatur	re. They are able to fill (naps in as well as exte
hatonomy	their knowledge using the literature and other source			
	pragmatically solve them by means of corresponding so	olutions and concepts.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points Examination	6 Project			
Examination duration and scale	based on task + presentation			
Assignment for the Following	General Engineering Science (German program): Spec	ialisation Electrical Engineering: Compulsory		
Curricula			mpulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Speci			
	General Engineering Science (English program, 7 sem		npulsory	
	Technomathematics: Specialisation III. Engineering Sci Technomathematics: Core qualification: Elective Comp			
	resident and the second qualification. Elective Comp	2.00. y		
Course L0640: Electrical Engineerin	ng Project Laboratory			
Тур	Laboratory Course			
Hrs/wk	5			
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-contain

Content	ropics and projects cover the entire field of applications of electrical engineering. Typically, the students will prototype functional units and self-contained
	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 completion of the projects (lecture notes, textbooks, manuals, data sheets, internet pages).



Module M0854: Mathematic	s IV					
Courses						
		T	Live feels	0.5		
Title		Тур	Hrs/wk	CP		
Differential Equations 2 (Partial Differentia		Lecture	2	1		
Differential Equations 2 (Partial Differentia	Equations) (L1044)	Recitation Section (small)	1	1		
Differential Equations 2 (Partial Differentia	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						
Educational Objectives	After taking part successfully, students have reached the	following loarning results				
· · · · ·	Aller laking part successiony, succents have reached the	lollowing learning results				
Professional Competence						
Knowledge						
	 Students can name the basic concepts in Mathematical Students 	natics IV. They are able to explain them using appr	opriate examples.			
	 Students can discuss logical connections between 	n these concepts. They are capable of illustrating	these connections wi	th the help of example		
	 They know proof strategies and can reproduce th 	em.				
Skills						
	 Students can model problems in Mathematics IV 	with the help of the concepts studied in this course	e. Moreover, they are	capable of solving th		
	by applying established methods.					
	 Students are able to discover and verify further lo 	gical connections between the concepts studied in	the course.			
		nd execute a suitable approach, and are able to crit		culto		
	• Tor a given problem, the students can develop a	in execute a suitable approach, and are able to chi	ically evaluate the re	suns.		
Personal Competence						
Social Competence	 Students are able to work together in teams. The 	vare capable to use mathematics as a common lar	011200			
	-					
	 In doing so, they can communicate new concept 	ts according to the needs of their cooperating part	ners. Moreover, they	can design example		
	check and deepen the understanding of their pee	ers.				
Autonomy	 Studente ere conchle of checking their underste 	nding of complex concents on their own. They co	n anaoifu anan guad	iono prosiooly and k		
	 Students are capable of checking their understa 	nding of complex concepts on their own. They ca	n specily open quesi	ions precisely and kr		
	where to get help in solving them.					
	 Students have developed sufficient persistence to 	b be able to work for longer periods in a goal-orient	ted 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 Equat	ions 2)				
Assignment for the Following	General Engineering Science (German program): Specia	alisation Electrical Engineering: Compulsory				
Curricula	General Engineering Science (German program): Specia	• • • •	nics: Compulsory			
Gurricula		• •				
	General Engineering Science (German program): Specia		ai Mechanical Engine	eering: Compulsory		
General Engineering Science (German program): Specialisation Naval Architecture: Compulsory						
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory					
	0 0 1 0 1	ester): Specialisation Mechanical Engineering Foo	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory			
	General Engineering Science (German program, 7 seme					
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se					
	General Engineering Science (German program, 7 seme					
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se	mester): Specialisation Mechanical Engineering,	Focus Theoretical N			
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se Compulsory General Engineering Science (German program, 7 seme	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso	Focus Theoretical N			
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso	Focus Theoretical N			
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory	Focus Theoretical N			
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory	Focus Theoretical N			
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory lisation Electrical Engineering: Compulsory	Focus Theoretical N			
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program): Specia	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory	Focus Theoretical №			
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program): Specia General Engineering Science (English program): Specia	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror	Focus Theoretical M ry nics: Compulsory	Mechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program): Specia	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Theoretica	Focus Theoretical M ry nics: Compulsory al Mechanical Engine	Mechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program): Specia General Engineering Science (English program): Specia	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Theoretica	Focus Theoretical M ry nics: Compulsory al Mechanical Engine	Mechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 se Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program): Specia	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor matics: Electrice Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Theoretics ster): Specialisation Electrical Engineering: Compu	Focus Theoretical M ry nics: Compulsory al Mechanical Engine ilsory	Mechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory Ilisation Electrical Engineering: Compulsory Ilisation Naval Architecture: Compulsory Ilisation Mechanical Engineering, Focus Mechatror Ilisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu ster): Specialisation Mechanical Engineering, Focu	Focus Theoretical M ry nics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con	Nechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory Ilisation Electrical Engineering: Compulsory Ilisation Naval Architecture: Compulsory Ilisation Mechanical Engineering, Focus Mechatror Ilisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu ster): Specialisation Mechanical Engineering, Focu	Focus Theoretical M ry nics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con	Nechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory Ilisation Electrical Engineering: Compulsory Ilisation Naval Architecture: Compulsory Ilisation Mechanical Engineering, Focus Mechatror Ilisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu ster): Specialisation Mechanical Engineering, Focu	Focus Theoretical M ry nics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con	Nechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory Ilisation Electrical Engineering: Compulsory Ilisation Naval Architecture: Compulsory Ilisation Mechanical Engineering, Focus Mechatror Ilisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu ster): Specialisation Mechanical Engineering, Focu mester): Specialisation Mechanical Engineering,	Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con Focus Theoretical M	Nechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory Ilisation Electrical Engineering: Compulsory Ilisation Naval Architecture: Compulsory Ilisation Mechanical Engineering, Focus Mechatror Ilisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu ster): Specialisation Mechanical Engineering, ster): Specialisation Mechanical Engineering, ster): Specialisation Naval Architecture: Compulso	Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con Focus Theoretical M	Nechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory Ilisation Electrical Engineering: Compulsory Ilisation Naval Architecture: Compulsory Ilisation Mechanical Engineering, Focus Mechatror Ilisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, ster): Specialisation Naval Architecture: Compulsor Engineering Sciences: Elective Compulsory	Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con Focus Theoretical M	Nechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory lisation Electrical Engineering: Compulsory ulisation Naval Architecture: Compulsory ulisation Mechanical Engineering, Focus Mechatror ulisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, ster): Specialisation Naval Architecture: Compulsory Engineering Sciences: Elective Compulsory Computer Science: Elective Compulsory	Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con Focus Theoretical M	Nechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory lisation Electrical Engineering: Compulsory ulisation Naval Architecture: Compulsory ulisation Mechanical Engineering, Focus Mechatror ulisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, ster): Specialisation Naval Architecture: Compulsory Engineering Sciences: Elective Compulsory Computer Science: Elective Compulsory	Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con Focus Theoretical M	Nechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Mec	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory lisation Electrical Engineering: Compulsory ulisation Naval Architecture: Compulsory ulisation Mechanical Engineering, Focus Mechatror ulisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, ster): Specialisation Naval Architecture: Compulsory Engineering Sciences: Elective Compulsory Computer Science: Elective Compulsory chanical Engineering: Compulsory	Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con Focus Theoretical M	Nechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Mec Mechanical Engineering: Specialisation Mechatronics: C	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory lisation Electrical Engineering: Compulsory ulisation Naval Architecture: Compulsory ulisation Mechanical Engineering, Focus Mechatror ulisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, ster): Specialisation Naval Architecture: Compulsory Engineering Sciences: Elective Compulsory Computer Science: Elective Compulsory chanical Engineering: Compulsory	Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con Focus Theoretical M	Nechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Mec Mechanical Engineering: Specialisation Mechatronics: Core Mechatronics: Core qualification: Compulsory	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory lisation Electrical Engineering: Compulsory ulisation Naval Architecture: Compulsory ulisation Mechanical Engineering, Focus Mechatror ulisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, ster): Specialisation Naval Architecture: Compulsory Engineering Sciences: Elective Compulsory Computer Science: Elective Compulsory chanical Engineering: Compulsory	Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con Focus Theoretical M	Nechanical Engineer		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathe Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Mec Mechanical Engineering: Specialisation Mechatronics: C	mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory lisation Electrical Engineering: Compulsory ulisation Naval Architecture: Compulsory ulisation Mechanical Engineering, Focus Mechatror ulisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, ster): Specialisation Naval Architecture: Compulsory Engineering Sciences: Elective Compulsory Computer Science: Elective Compulsory chanical Engineering: Compulsory	Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory Is Mechatronics: Con Focus Theoretical M	Nechanical Engineer		



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	
CP	1
	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	
	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



Module M0675: Introductio	n to Communications and Random Processes				
Courses					
Title		Тур	Hrs/wk	CP	
Introduction to Communications and Rand	lom Processes (L0442)	Lecture	3	4	
Introduction to Communications and Random Processes (L0443) Recitation Section (large) 1				2	
Module Responsible	Prof. Gerhard Bauch				
Admission Requirements	None				
Recommended Previous					
Knowledge	Mathematics 1-3				
	Signals and Systems				
	Basic knowledge of probability theory				
Educational Objectives	After taking part successfully, students have reached the following	learning results			
Professional Competence					
Knowledge	The students know and understand the fundamental building bloc	ks of a communications system. They ca	an describe and analy	rse the individual building	
	blocks using knowledge of signal and system theory as well as	s the theory of stochastic processes. T	he are aware of the	essential resources and	
	evaluation criteria of information transmission and are able to design and evaluate a basic communications system.				
Skills	The students are able to design and evaluate a basic commun	nications system. In particular, they can	n estimate the requir	ed resources in terms of	
	bandwidth and power. They are able to assess essential evaluat	ion parameters of a basic communicati	ons 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 appro	priate literature sources. They can con	trol their level of know	vledge during the lecture	
	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 E	Electrical Engineering: Compulsory			
Curricula	General Engineering Science (German program, 7 semester): Spe	ecialisation Electrical Engineering: Com	pulsory		
	Computer Science: Specialisation Computer and Software Engine	ering: Elective Compulsory			
	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	oulsory		
	Computational Science and Engineering: Specialisation Engineer	ing Sciences: Elective Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Elec	tive Compulsory			
	Technomathematics: Core qualification: Elective Compulsory				



Course L0442: Introduction to Comm	nunications and Random Processes
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	WiSe
	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.
L	

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



Module M0783: Measureme	ents: Methods and Data Processing			
Courses				
Title		Тур	Hrs/wk	СР
EE Experimental Lab (L0781)		Laboratory Course	2	2
Measurements: Methods and Data Proces	ssing (L0779)	Lecture	2	3
Measurements: Methods and Data Proces	ssing (L0780)	Recitation Section (small)	1	1
Module Responsible	Prof. Alexander Schlaefer			
Admission Requirements	none			
Recommended Previous	principles of mathematics			
Knowledge	principles of electrical engineering			
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	The students are able to explain the purpose of metrology and theory and errors, and explain the processing of stochastic signature of the stochastic signature of the stochastic signature of the stochastic sto		-	
Skills	The students are able to evaluate problems of metrology and	to apply methods for describing and proces	sing of measurements	
Personal Competence				
Social Competence	The students solve problems in small groups.			
Autonomy	The students can reflect their knowledge and discuss and eva	aluate their results.		
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): Specialisat	ion Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester)	: Specialisation Electrical Engineering: Elec	tive Compulsory	
	Computer Science: Specialisation Computer and Software Er	ngineering: Elective Compulsory		
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisati	on Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester):	Specialisation Electrical Engineering: Elect	ive Compulsory	
	Computational Science and Engineering: Specialisation Engi	neering Sciences: Elective Compulsory		
	Computational Science and Engineering: Specialisation Com	puter Science: Elective Compulsory		
	Technomathematics: Specialisation III. Engineering Science:	Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			

Course L0781: EE Experimental Lab	
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: Methods and Data Processing	
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	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
CP	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



Module M0568: Theoretical	Electrical Engineering II: Time-Dependen	t Fields		
Courses				
Title		Тур	Hrs/wk	CP
Theoretical Electrical Engineering II: Time-	Dependent Fields (L0182)	Lecture	3	5
Theoretical Electrical Engineering II: Time-		Recitation Section (small)	2	1
Module Responsible	Prof. Christian Schuster			
Admission Requirements	None			
Recommended Previous	Electrical Engineering I, Electrical Engineering II, Theore	tical Electrical Engineering I		
Knowledge	Mathematics I, Mathematics II, Mathematics III, Mathemat			
Educational Objectives	After taking part successfully, students have reached the	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 for 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).	tasks in small groups. They are able to prese	ent their results effective	ely (e.g. during exercise
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				
Assignment for the Following	General Engineering Science (German program): Specia	alisation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 seme		mpulsory	
	Electrical Engineering: Core qualification: Compulsory		· ·	
	General Engineering Science (English program): Specia	lisation Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 seme	ster): Specialisation Electrical Engineering: Cor	npulsory	
	Technomathematics: Specialisation III. Engineering Scie	nce: Elective Compulsory		
I				



Тур	Lecture
Hrs/wk	3
CP	
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)



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 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 n	naterials, basics in solid-state physics		
Knowledge	Successful participation of Physics for Engineers and Materials in El	ectrical Engineering or courses with e	quivalent contents	
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence				
Knowledge				
	Students are able			
	• to represent the basics of semiconductor physics,			
	to explain the operating principle of important semiconductor	devices,		
	to outline device characteristics and equivalent circuits as we	II 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 problems 	s by oneself		
Personal Competence				
Social Competence	Students are able to prepare and perform their lab experiments in te	am work as well as to present and dis	cuss the results in from	t of audience.
Autonomy	Students are capable to acquire knowledge based on literature in or	der 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 Ele	ctrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Speci	alisation Electrical Engineering: Com	oulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Electronic Science (English program): Specialisation (English program): Spec			
	General Engineering Science (English program, 7 semester): Specia	alisation Electrical Engineering: Comp	oulsory	



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; MESFET: operating principle, depletion mode and enhancement mode MESFET; MIS structure: accumulation, depletion, inversion, strong inversion, flatband voltage, oxide 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	Course L0721: Electronic Devices	
Тур	Problem-based Learning	
Hrs/wk	2	
CP	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 M0777: Semicondu	ctor Circuit Design			
Courses				
Title		Tup	Hrs/wk	CP
Semiconductor Circuit Design (L0763)		Typ 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	e following learning results		
Professional Competence				
Knowledge				
0	 Students are able to explain the functionality of one of the students are able to explain the functionality of the students. 			
	 Students know the fundamental digital logic circ 	uits and can discuss their advantages and disadva	ntages.	
		ircuits and can explain their functionality and speci	fications.	
	 Students are able to explain how analog circuits 	functions and where they are applied.		
	 Students know the appropriate fields for the use 	of bipolar transistors.		
Skills				
	 Students can calculate the specifications of diffe 		of electronic circuits.	
		its and can design different types of logic circuits.		
	 Students can use MOS devices, operational amplication 	plifiers and bipolar transistors for specific applicatio	ins.	
Personal Competence				
Social Competence				
	 Students are able work efficiently in heterogene 	ous teams.		
	 Students working together in small groups can s 	olve problems and answer professional questions		
Autonomy				
	 Students are able to assess their level of knowle 	edge.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam 120 min			
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): Spec			
Curricula	General Engineering Science (German program): Spec	6 6,	, ,	
	General Engineering Science (German program, 7 sem			
	General Engineering Science (German program, 7 sem	ester): Specialisation Mechanical Engineering, For	cus Mechatronics: Con	npulsory
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Speci	alisation Electrical Engineering: Compulsory		
	General Engineering Science (English program): Speci	alisation Mechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (English program, 7 sem	ester): Specialisation Electrical Engineering: Comp	ulsory	
	General Engineering Science (English program, 7 sem	ester): Specialisation Mechanical Engineering, Foc	us Mechatronics: Com	pulsory
	Mechanical Engineering: Specialisation Mechatronics:	Compulsory		
	Mechatronics: Core qualification: Compulsory			
	Technomathematics: Core qualification: Elective Comp	ulsory		
	Technomathematics: Specialisation III. Engineering Sci	•		



Course L0763: Semiconductor Circ	uit Design
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	 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



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	Course L0864: Semiconductor Circ	uit Design
CP 2 Workload in Hours Independent Study Time 46, Study Time in Lecture 14 Lecturer INN 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 • Realization of CMOS circuits and further perfomance improvements • Operational amplifiers and their applications • Basic circuits with bipolar transistors • Design of seemplany circuits • Electrical behavoir of BiCMOS circuits Literature R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 0471700555 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, Halbielter-Schaltungstechnik, Springer Verlag, 14. Auflage, 2012, ISBN 3540428496 H. Gobel, Einführung in die Halbielter-Schaltungstechnik, Springer Verlag, 14. Auflage, 2011, ISBN: 9783642208874 U. Tietze und Ch. Schenk, E. Gamm, Halbielter-Schaltungstechnik, Berlin, Heidelberg, 2011, ISBN: 9783642208874 URL: http://dx.doi.org/10.1007/978-3-842-20887-4	Тур	Recitation Section (small)
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 performance 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 H - G. 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 ISB 9783642208867 URL: http://site.ebrary.com/lib/alltites/docDetail action?docID=10493499 URL: http://site.ebrary.com/lib/alltites/docDetail action?docID=10493499	Hrs/wk	1
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 BIGMOS circuits Electrical behavoir of BIGMOS circuits Electrical behavoir of BIGMOS circuits 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, Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208877 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 Electrical berlay com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 Electrical berlay com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 Electrical berlay com/lib/alltitles/docDetail.action?docID	CP	2
Language DE Cycle SoSe Content 	Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
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 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, Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208874 ISB 9783642208867 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4	Lecturer	NN
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 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 ISB 9783642208867 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4	Language	DE
 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 3519004674 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944 U. Tietze und Ch. Schenk, E. Gamm, Halbleiter-Schaltungstechnik, Berlin, Heidelberg Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208874 ISB 9783642208867 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4	Cycle	SoSe
URL: http://www.ciando.com/img/bo	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 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://beooks.ciando.com/book/index.cfm/bok_id/319955



Courses				
ïtle		Тур	Hrs/wk	CP
troduction to Management (L0880)		Lecture Problem-based Learning	3 2	3 3
roject Entrepreneurship (L0882)	Dref Christen h lh	Problem-based Learning	2	3
Module Responsible				
Admission Requirements Recommended Previous				
Knowledge	Basic Knowledge of Mathematics and Business			
Educational Objectives	After taking part successfully, students have reached the fo	llowing learning results		
Professional Competence	Aller taking part successibility, successibility, successibility, successibility,	nowing learning results		
Knowledge	After taking this module, students know the important basi	ice of many different areas in Rusiness and Ma	accoment from Plan	ing and Organisation
, nomeage	Marketing and Innovation, and also to Investment and Con			
	explain the differences between Economics and Ma	anagement 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 I	• • •		•
	describe and explain basic business functions as		chain management, o	organization and hurr
	ressource management, information management,	• •	Itiple chiectives and	upportainty and aval
	 explain the relevance of planning and decision m some basic methods from mathematical Finance 	laking in business, esp. in situations under nu	niple objectives and	uncentainty, and expl
	 state basics from accounting and costing and select 	ted controlling methods		
Skills	Students are able to analyse business units with res Entrepreneurship project in a team. In particular, they are a		tives, strategies etc.) and to carry out
	 analyse Management goals and structure them app 	propriately		
	 analyse management goals and studente them app analyse organisational and staff structures of compa 			
	 apply methods for decision making under multiple of 			
	 analyse production and procurement systems and I 			
	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 a	controlling to predefined problems		
Personal Competence				
Social Competence				
	 work successfully in a team of students 			
	 to apply their knowledge from the lecture to an entre 	epreneurship 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 themselve	S		
	 to write a report on their project. 			
Workload in Hours Credit points	, , ,			
Examination	Written exam			
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): Specialis	sation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialis	sation Computer Science: Compulsory		
	General Engineering Science (German program): Specialis	sation Process Engineering: Compulsory		
	General Engineering Science (German program): Specialis	sation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis	1 6 6 1 ,	ompulsory	
		sation Energy and Enviromental Engineering: Co	1	
	General Engineering Science (German program): Specialis	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Co	1	
	General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Co sation Mechanical Engineering: Compulsory	1	
	General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Co sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory	1	
	General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Co sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Comp	ulsory	
	General Engineering Science (German program): Specialis General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Co sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu er): Specialisation Process Engineering: Compu	ulsory Isory	
	General Engineering Science (German program): Specialis General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Co sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu er): Specialisation Process Engineering: Compu er): Specialisation Biomedical Engineering: Comp	ulsory Isory Ipulsory	
	General Engineering Science (German program): Specialis General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Co sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu er): Specialisation Process Engineering: Compu er): Specialisation Biomedical Engineering: Compu er): Specialisation Naval Architecture: Compulsor	ulsory Isory Ipulsory Ipulsory Iry	
	General Engineering Science (German program): Specialis General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Co sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu er): Specialisation Process Engineering: Compu er): Specialisation Biomedical Engineering: Compu er): Specialisation Naval Architecture: Compulsor er): Specialisation Computer Science: Compulsor	ulsory Isory Ipulsory Ipulsory Iry	
	General Engineering Science (German program): Specialit General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Con sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu er): Specialisation Process Engineering: Compu er): Specialisation Biomedical Engineering: Compulsor er): Specialisation Naval Architecture: Compulsor er): Specialisation Computer Science: Compulsor er): Specialisation Bioprocess Engineering: Com	ulsory Isory Ipulsory Ipulsory Iry Ipulsory	
	General Engineering Science (German program): Speciali General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Con sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu er): Specialisation Process Engineering: Compu er): Specialisation Biomedical Engineering: Compulsor er): Specialisation Naval Architecture: Compulsor er): Specialisation Computer Science: Compulsor er): Specialisation Bioprocess Engineering: Com er): Specialisation Bioprocess Engineering: Compulsor er): Specialisation Civil Engineering: Compulsor	ulsory Isory Isory Ipulsory Iry Ipulsory Ipulsory Y	
	General Engineering Science (German program): Specialit General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Cri sation Civil- and Enviromental Engeneering: Con sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu- er): Specialisation Process Engineering: Compu- er): Specialisation Biomedical Engineering: Compu- er): Specialisation Naval Architecture: Compulsor er): Specialisation Computer Science: Compulsor er): Specialisation Bioprocess Engineering: Com- er): Specialisation Bioprocess Engineering: Com- er): Specialisation Civil Engineering: Compulsor er): Specialisation Civil Engineering: Compulsor er): Specialisation Energy and Enviromental Eng	npulsory Isory Isory npulsory ny npulsory y jineering: Compulsor	
	General Engineering Science (German program): Specialit General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Con sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu- er): Specialisation Process Engineering: Compu- er): Specialisation Biomedical Engineering: Compu- er): Specialisation Naval Architecture: Compulsor er): Specialisation Computer Science: Compulsor er): Specialisation Bioprocess Engineering: Com- er): Specialisation Computer Science: Compulsor er): Specialisation Civil Engineering: Compulsor er): Specialisation Energy and Enviromental Eng- er): Specialisation Mechanical Engineering, Foc	npulsory Isory Isory Ipulsory Inpulsory Ipulsory Y jineering: Compulsor us Mechatronics: Cor	npulsory
	General Engineering Science (German program): Specialit General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Con sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu- er): Specialisation Process Engineering: Compu- er): Specialisation Biomedical Engineering: Compu- er): Specialisation Naval Architecture: Compulsor er): Specialisation Computer Science: Compulsor er): Specialisation Bioprocess Engineering: Com- er): Specialisation Computer Science: Compulsor er): Specialisation Civil Engineering: Compulsor er): Specialisation Energy and Enviromental Eng- er): Specialisation Mechanical Engineering, Foc er): Specialisation Mechanical Engineering, Foc	ulsory Isory Isory Ipulsory Iry Ipulsory y jineering: Compulsor us Mechatronics: Cor us Biomechanics: Co	npulsory mpulsory
	General Engineering Science (German program): Specialit General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Con sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu- er): Specialisation Process Engineering: Compulsor er): Specialisation Biomedical Engineering: Compulsor er): Specialisation Naval Architecture: Compulsor er): Specialisation Biomedical Engineering: Compu- er): Specialisation Ocomputer Science: Compulso er): Specialisation Bioprocess Engineering: Com- er): Specialisation Civil Engineering: Compulsor er): Specialisation Energy and Enviromental Eng- er): Specialisation Mechanical Engineering, Foc er): Specialisation Mechanical Engineering, Foc	ulsory Isory Isory Ipulsory Inpulsory Inpulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems Ei	npulsory mpulsory ngineering: Compulso
	General Engineering Science (German program): Specialit General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Con sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu- er): Specialisation Process Engineering: Compulsor er): Specialisation Biomedical Engineering: Compulsor er): Specialisation Naval Architecture: Compulsor er): Specialisation Biomedical Engineering: Compu- er): Specialisation Ocomputer Science: Compulso er): Specialisation Bioprocess Engineering: Com- er): Specialisation Civil Engineering: Compulsor er): Specialisation Energy and Enviromental Eng- er): Specialisation Mechanical Engineering, Foc er): Specialisation Mechanical Engineering, Foc	ulsory Isory Isory Ipulsory Inpulsory Inpulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems Ei	npulsory mpulsory ngineering: Compulso
	General Engineering Science (German program): Specialit General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Energy and Enviromental Engineering: Co sation Civil- and Enviromental Engeneering: Co sation Mechanical Engineering: Compulsory sation Biomedical Engineering: Compulsory sation Naval Architecture: Compulsory er): Specialisation Electrical Engineering: Compu- er): Specialisation Process Engineering: Compulsor er): Specialisation Naval Architecture: Compulsor er): Specialisation Naval Architecture: Compulsor er): Specialisation Biomedical Engineering: Compu- er): Specialisation Ocomputer Science: Compulsor er): Specialisation Bioprocess Engineering: Compu- er): Specialisation Computer Science: Compulsor er): Specialisation Energy and Enviromental Eng- er): Specialisation Mechanical Engineering, Foc er): Specialisation Mechanical Engineering, Foc er): Specialisation Mechanical Engineering, Foc er): Specialisation Mechanical Engineering, Foc	ulsory lsory pulsory pry pry pulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems Ei I, Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Scienc



Compulsory
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productio
Compulsory
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 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 Energy and Enviromental 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 Enviromental 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; Compulson
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 Theoretical Mechanical Engineering
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Productio
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



	Locture
,,	Lecture
	3
	3
	Independent Study Time 48, Study Time in Lecture 42
	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgar
	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
0 0	DE
	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.	



Specialization Computer Science

Module M0561: Discrete Al	gebraic Structures			
Courses				
Title		Тур	Hrs/wk	CP
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 followin	g learning results		
Professional Competence				
Knowledge	The students know the important basics of discrete algebraic s	ructures including elementary combinat	orial structures, mono	ids, groups, rings, fields
	finite fields, and vector spaces. They also know specific structure	s like sub sum-, and quotient structures	and homomorphisms.	
Skille	Students are able to formalize and analyze basic discrete algebra			
Skiils	Students are able to formalize and analyze basic discrete algebra	ale 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 standa	rd backs and to approvide the aquirad kr	awladge to other also	
Autonomy	Students are able to acquire new knowledge from specific standa	ind books and to associate the addited ki	lowledge to other class	585.
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). Specialisation General Engineering Science (German program, 7 semester): Sp		sorv	
Gurricula	Computer Science: Core qualification: Compulsory	control of the computer ocience. Computer		
	General Engineering Science (English program): Specialisation	Computer Science: Compulsory		
	General Engineering Science (English program, 7 semester): Sp		orv	
	Computational Science and Engineering: Core qualification: Cor			
	Technomathematics: Specialisation I. Mathematics: Elective Com			
		,		

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



	ted Programming, Algorithms and I			
Courses				
Title		Тур	Hrs/wk	CP
Objectoriented Programming, Algorithms a	nd Data Structures (L0131)	Lecture	4	4
Objectoriented Programming, Algorithms a	nd Data Structures (L0132)	Recitation Section (small)	1	2
Module Responsible	Prof. Rolf-Rainer Grigat			
Admission Requirements	None			
Recommended Previous	Lecture Prozedurale Programmierung or equival	lent proficiency in imperative programming		
Knowledge	Mandatory prerequisite for this lecture is proficie	ency in imperative programming (C, Pascal, Fortran or s	imilar). You should be	familiar with simple d
		e, for, while, procedure calls or function calls, pointers, a		
		th editor, compiler, linker and debugger. In this lecture v		-
	objects and we will not repeat the basics mentior			
		S, LUM because those prerequisites are not part of the c		
	those curricula in general. The programs ET, CI a	and IIW include those prerequisites in the first semester in	the lecture Prozedura	ale Programmierung.
	A			
Educational Objectives	After taking part successfully, students have reac	rhed the following learning results		
Professional Competence Knowledge	Students can explain the eccentials of softwar	a decign and the decign of a class prohitecture with r	oforonoo to ovisting of	ass librarias and dasi
Kilowiedge	patterns.	e design and the design of a class architecture with re	sterence to existing ci	ass libraries and desi
	patients.			
	Students can describe fundamental data structur	res of discrete mathematics and assess the complexity of	important algorithms for	or sorting and searchin
Skills	Students are able to			
	 Design software using given design patter 	erns and applying class hierarchies and polymorphism		
		s using version management systems and Google Test		
	Sort and search for data efficiently			
	Assess the complexity of algorithms.			
Personal Competence				
Social Competence	Students can work in teams and communicate in	forums.		
Autonomy	Students are able to solve programming tasks su	uch as LZW data compression using SVN Repository an	d Google Test indeper	ndently and over a peri
	of two to three weeks.			
Workload in Hours	Independent Study Time 110, Study Time in Lect	ture 70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 Minutes, Content of Lecture, exercises and m			
Assignment for the Following): Specialisation Computer Science: Compulsory		
Curricula		, 7 semester): Specialisation Computer Science: Comput	sory	
	Computer Science: Core qualification: Compulso	•		
	Electrical Engineering: Core qualification: Comp			
	General Engineering Science (English program)		2011	
	Computational Science and Engineering: Core of	7 semester): Specialisation Computer Science: Computer	JULY	
	Logistics and Mobility: Specialisation Engineering			



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 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	



Module M0624: Logic, Auto	mata and Formal Languages				
Courses					
Title		Тур	Hrs/wk	CP	
Logic, Automata Theory and Formal Languages (L0332)		Lecture	2	4	
Logic, Automata Theory and Formal Langu	uages (L0507)	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.e.	- specify algorithms for simple data structures (such as, e.g., arrays) to solve computational problems			
	- apply propositional logic and predicate logic for specifying	ng and understanding mathematical proofs			
	- apply the knowledge and skills taught in the module Disc	crete Algebraic Structures			
Educational Objectives	After taking part successfully, students have reached the f	ollowing learning results			
Professional Competence					
Skills	Students can show correspondences to Boolean algebra. Students can describe which application problems are hard to represent with propositional logic, and therefore, the students can motivate predicate logic, and define syntax, semantics, and decision problems for this representation formalism. Students can explain unification and resolution for solving the predicate logic SAT decision problem. Students can also describe syntax, semantics, and decision problems for various kinds of temporal logic, and identify their application areas. The participants of the course can define various kinds of finite automata and can identify relationships to logic and formal grammars. The spectrum that students can explain ranges from deterministic and nondeterministic finite automata and pushdown automata to Turing machines. Students can name those formalism for which nondeterminism is more expressive than determinism. They are also able to demonstrate which decision problems require which expressivity, and, in addition, students can transform decision problems w.r.t. one formalism into decision problems w.r.t. other formalisms. They understand that some formalisms easily induce algorithms whereas others are best suited for specifying systems and their properties. Students can describe the relationships between formalisms such as logic, automata, or grammars.				
	nondeterministic automata into deterministic ones, or derive grammars from automata and vice versa. They can show how parsers work, and they can apply algorithms for the language emptiness problem in case of infinite words.				
_					
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): Special		Compulson		
Curricula	General Engineering Science (German program, 7 semes Computer Science: Core qualification: Compulsory	ser). Specialisation Computer Science: Elective (compulsory		
	General Engineering Science (English program): Speciali	isation Computer Science: Compulsory			
		ter): Specialisation Computer Science: Elective (Compulsory		
	Computational Science and Engineering: Core qualification	ter): Specialisation Computer Science: Elective C on: Compulsory	Compulsory		



Course L0332: Logic, Automata The	ory and Formal Languages
Тур	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Tobias Knopp
Language	EN
Cycle	SoSe
-	3039
Content	1. Propositional logic, Boolean algebra, propositional resolution, SAT-2KNF
	2. Predicate logic, unification, predicate logic resolution
	3. Temporal Logics (LTL, CTL)
	4. Deterministic finite automata, definition and construction
	5. 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 logi
	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: Logic, 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 M0672: Signals and		
Courses		
ïtle	Typ Hrs/wk	CP
ignals and Systems (L0432)	Lecture 3	4
ignals 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 Mathem	atik 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		
	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse	
	and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image	e domain which
Chille	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 can analyse and design basic systems regarding important properties such as magnitude and phase response, stability, linearity e	
	the impact of LTI systems on the signal properties in time and frequency domain.	nc mey can ass
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	ae during the lect
, laterierity	period by solving tutorial problems, software tools, clicker system.	go danng no looi
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: Compu	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Comp General Engineering, Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Comp	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engin General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in En	
	Compulsory	igineening Scienc
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Comput	lsorv
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mech	
	Compulsory	j
	Computer Science: Core qualification: Compulsory	
	Electrical Engineering: Core qualification: 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 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 Process Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
	General Engineering Science (English program, 7 semissic): Specialisation Bioprocess Engineering: Compulsory	
	General Engineering Science (English program, 7 semissic): Specialisation Bioinculat Engineering, Focus Biomechanics: Comput	Isory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Comp	-
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engine	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in En	
	Compulsory	-
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compute	sory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mech	nanical Engineer
	Compulsory	
	Computational Science and Engineering: Core qualification: Compulsory	
	Mechatronics: Core qualification: Compulsory	



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Courses I 0422: Signale and Systems				
Course L0432: Signals and Systems	s 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	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 LTL systems in time and frequency domain			
	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				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880) roject Entrepreneurship (L0882)		Lecture Problem-based Learning	3	3 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 for	ollowing learning results		
Professional Competence				
Knowledge	After taking this module, students know the important bas Marketing and Innovation, and also to Investment and Cor		nagement, from Plan	ning and Organisation
Skills	 explain the differences between Economics and M field of Management explain the most important aspects of and goals in describe and explain basic business functions as ressource management, information management, explain the relevance of planning and decision n some basic methods from mathematical Finance state basics from accounting and costing and select Students are able to analyse business units with re 	Management and name the most important aspe s production, procurement and sourcing, supply , innovation management and marketing naking in Business, esp. in situations under mu cted controlling methods. spect to different criteria (organization, object	ects of entreprneurial j chain management, ultiple objectives and	projects organization and hum uncertainty, and expl:
	Entrepreneurship project in a team. In particular, they are a analyse Management goals and structure them ap analyse organisational and staff structures of comp apply methods for decision making under multiple analyse production and procurement systems and analyse and apply basic methods of marketing select and apply basic methods from mathematical apply basic methods from accounting, costing and	propriately panies objectives, under uncertainty and under risk Business information systems I finance 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 entr to communicate appropriately and to cooperate respectfully with their fellow students.		t on the project	
Autonomy	Students are able to work in a team and to organize the team themselve 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 Minuten			
Assignment for the Following	General Engineering Science (German program): Special	isation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Special	isation Computer Science: Compulsory		
	General Engineering Science (German program): Special	isation Process Engineering: Compulsory		
	General Engineering Science (German program): Special	1 0 0 1 ,		
	General Engineering Science (German program): Special	6, 6 6	1	
	General Engineering Science (German program): Special		mpulsory	
	General Engineering Science (German program): Special General Engineering Science (German program): Special			
	General Engineering Science (German program): Special			
	General Engineering Science (German program, 7 semes		oulsory	
	General Engineering Science (German program, 7 semes	ter): Specialisation Process Engineering: Compu	ulsory	
	General Engineering Science (German program, 7 semes	ter): Specialisation Biomedical Engineering: Cor	mpulsory	
	General Engineering Science (German program, 7 semes		-	
	General Engineering Science (German program, 7 semes		•	
	General Engineering Science (German program, 7 semes			
	General Engineering Science (German program, 7 semes General Engineering Science (German program, 7 semes			v
	General Engineering Science (German program, 7 series General Engineering Science (German program, 7 series			
	General Engineering Science (German program, 7 series General Engineering Science (German program, 7 series	, , , , , , , , , , , , , , , , , , , ,		
		tor): Specialization Mechanical Engineering Eq	cus Aircraft Systems E	naineerina: Compulso
	General Engineering Science (German program, 7 semes General Engineering Science (German program, 7 ser Compulsory			
		mester): Specialisation Mechanical Engineering	g, Focus Materials ir	Engineering Scienc



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
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 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 Energy and Enviromental 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 Enviromental 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: 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 CP	Lecture 3
СР	
-	
Workload in Hours	3
	Independent Study Time 48, Study Time in Lecture 42
	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgar
	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
0 0	DE
	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 M0852: Graph Theo	bry and Optimization			
Courses				
Title		Тур	Hrs/wk	CP
Graph Theory and Optimization (L1046)		Lecture	2	3
Graph Theory and Optimization (L1047)		Recitation Section (small)	2	3
Module Responsible	Prof. Anusch Taraz			
Admission Requirements	none			
Recommended Previous	Discrete Algebraic Structures			
Knowledge	Mathematics I			
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	 Students can name the basic concepts in Graph Theory 	and Ontimization. They are able to evolution	them using appropri-	ate examples
	 Students can discuss logical connections between thes 			
	 They know proof strategies and can reproduce them. 			
Skills	 Students can model problems in Graph Theory and Op 	timization with the help of the concepts stud	lied in this course. M	oreover, they are capable
	of solving them by applying established methods.			
	Students are able to discover and verify further logical c	connections between the concepts studied in	n the course.	
	For a given problem, the students can develop and exer	cute a suitable approach, and are able to cri	itically evaluate the re	esults.
Personal Competence Social Competence	 Students are able to work together in teams. They are c 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 where to get help in solving them. Students have developed sufficient persistence to be at 			
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): Specialisatio			
Curricula	General Engineering Science (German program, 7 semester):	Specialisation Computer Science: Compulse	ory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): S		лу	
	Computational Science and Engineering: Core qualification: Co Logistics and Mobility: Specialisation Engineering Science: Ele			
	Technomathematics: Specialisation I. Mathematics: Elective Co			



Course L1046: Graph Theory and Optimization		
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 Optimization	
Тур	Recitation Section (small)
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	See interlocking course
Literature	See interlocking course



Module M0793: Seminars C	Computer Science and Mathematics			
Courses				
Title		Тур	Hrs/wk	CP
Seminar Computational Mathematics/Computer Science (L0797)		Seminar	2	2
Seminar Computational Engineering Science (L0796)		Seminar	2	2
Seminar Engineering Mathematics/Computer Science (L1781)		Seminar	2	2
Module Responsible	Prof. Karl-Heinz Zimmermann			
Admission Requirements	None			
Recommended Previous	Basic knowledge in Computer Science, Mathematics, 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	4		
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): Spe	ecialisation Computer Science: Compulsory		
	General Engineering Science (English program, 7 se	emester): Specialisation Computer Science: Com	npulsory	
	Computational Science and Engineering: Core qualif	fication: Compulsory		

Course L0797: Seminar Computational 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-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	CP
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 the	following learning results		
Professional Competence				
Knowledge	Students are able to explain important and common Inte	rnet protocols in detail and classify them, in orde	er 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 of	professional knowledge and can independently	earn and understand i	t.
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): Specia	alisation Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 seme	ester): Specialisation Computer Science: Elective	Compulsory	
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Elective Comp	oulsory		
	General Engineering Science (English program): Specia	lisation Computer Science: Compulsory		
	General Engineering Science (English program, 7 seme	ster): Specialisation Computer Science: Elective	Compulsory	
	Computational Science and Engineering: Core qualification			
	Technomathematics: Specialisation II. Informatics: Election			
	Technomathematics: Specialisation II. Informatics: Election	ve Compulsory		

Course L1098: Computer Networks	and Internet Security
Тур	Lecture
Hrs/wk	3
CP	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	



Medule Mecco, New Street	Asthematica I			
Module M0662: Numerical I				
Courses				
Title		Тур	Hrs/wk	CP
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	Mathematik I + II for Engineering Students (german or	english) or Analysis & Linear Algebra I + I	I for Technomathematiciz	ans
Knowledge	basic MATLAB knowledge			
	-			
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	Students are able to			
	 name numerical methods for interpolation, integratio 	n, least squares problems, eigenvalue p	roblems, nonlinear root	finding problems and
	explain their core ideas,			
	 repeat convergence statements for the numerical methods 	nods,		
	explain aspects for the practical execution of numerical	I methods with respect to computational a	nd storage complexitx.	
0.111				
Skills	Students are able to			
	• implement, apply and compare numerical methods us	ing MATLAB,		
	justify the convergence behaviour of numerical method	ds with respect to the problem and solution	n algorithm,	
	 select and execute a suitable solution approach for a generative select and execute a suitable solution. 	given problem.		
Personal Competence				
Social Competence	Students are able to			
eedal eempetenee				
	work together in heterogeneously composed teams (dge), explain theoretic
	foundations and support each other with practical asp	ects regarding the implementation of algor	ithms.	
Autonomy	Students are capable			
	 to paper whether the supporting theoretical and process. 	ical averaicae are better actual individua	lly or in a toom	
	 to assess whether the supporting theoretical and pract to assess their individual progess and, if necessary, to 		iny or in a team,	
	• to assess their individual progess and, in 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): Specialisat	ion Computer Science: Compulsory		
Curricula	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisat		als in Engineering Scien	ices: Compulsory
	General Engineering Science (German program): Specialisat		ulcon	
	General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semes			Engineering Science
	Compulsory			ngmoening ouenice
	General Engineering Science (German program, 7 semester)	: Specialisation Biomedical Engineering: (Compulsory	
	General Engineering Science (German program, 7 semester)			mpulsory
	Bioprocess Engineering: Specialisation A - General Bioproce			*
	Computer Science: Specialisation Computational Mathematic	s: Elective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsor	ry		
	General Engineering Science (English program): Specialisati	on Computer Science: Compulsory		
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program): Specialisati			ces: Compulsory
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semesi	ter): Specialisation Mechanical Engineer	ring, Focus Materials in	Engineering Science
	Compulsory	Openialization Discussion 7		
	General Engineering Science (English program, 7 semester):			moulconv
	General Engineering Science (English program, 7 semester):	opecialisation viechanical Engineering, F	ocus piomecrianics: Cor	npuisury
	Computational Science and Engineering: Core qualification:	Compulsory		



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 f ür Ingenieure und Naturwissenschaftler, Springer

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 M0731: Functional	Programming			
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 t	the following learning results		
Professional Competence				
Knowledge	Students apply the principles, constructs, and simpl	le design techniques of functional programming. T	hey demonstrate the	ir ability to read Hask
	programs and to explain Haskell syntax as well as H	laskell's read-eval-print loop. They interpret warning	is and find errors in p	programs. They apply t
	fundamental data structures, data types, and type cor	nstructors. They employ strategies for unit tests of fur	nctions and simple pr	roof techniques for part
	and total correctness. They distinguish laziness from c	other evaluation strategies.		
Skills	Students break a natural-language description down			
	They assess different language constructs, make co	nscious selections both at specification and implem	nentations level, and	justify their choice. Th
	analyze given programs and rewrite them in a controlled way. They design and implement unit tests and can assess the quality of their tests. The			
	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. The			
	communicate in English.			on programe erange m
Autonomy	In programming labs, students learn under supervision	ion (a.k.a. "Betreutes Programmieren") the mechanic	cs of programming. Ir	n exercises, they devel
	solutions individually and independently, and receive	feedback.		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84	k.		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Spe	ecialisation Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 se	mester): Specialisation Computer Science: Elective (Compulsory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Spe	cialisation Computer Science: Compulsory		
	General Engineering Science (English program, 7 ser		Compulsory	
	Computational Science and Engineering: Specialisati			
	Technomathematics: Specialisation II. Informatics: Ele			

Course L0624: Functional Programming		
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 Programming 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			
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.		



Module M0791: Computer /	Architecture			
Courses				
Title		Тур	Hrs/wk	CP
Computer Architecture (L0793)		Lecture	2	3
Computer Architecture (L0794)		Problem-based Learning	2	2
Computer Architecture (L1864)		Recitation Section (small)	1	1
Module Responsible	Prof. Heiko Falk			
Admission Requirements	None			
Recommended Previous	Module "Computer Engineering"			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fol	lowing learning results		
Professional Competence				
Knowledge	This module presents advanced concepts from the discipl	ine of computer architecture. In the beginning,	a broad overview ov	ver various programmi
	models is given, both for general-purpose computers and	d for special-purpose machines (e.g., signal p	rocessors). Next, fou	ndational aspects of
	micro-architecture of processors are covered. Here, the for	cus particularly lies on the so-called pipelining	and the methods us	ed for the acceleratior
	instruction execution used in this context. The students	get to know concepts for dynamic scheduling.	branch prediction,	superscalar executior
	machine instructions and for memory hierarchies.			
Skille	The students are able to describe the organization of proce	score. They know the different architectural prin	ciplos and programm	ing models. The stude
Skiils	examine various structures of pipelined processor archite			-
	performance or energy efficiency. They evaluate differen		-	
	distinguish between instruction- and data-level parallelism.		aller computer archit	ectures and are able
	distinguish between instruction- and data-level parallelism.			
Personal Competence				
Social Competence	Students are able to solve similar problems alone or in a gr	oup and to present the results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific I	iterature and to associate this knowledge with o	ther classes.	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes, contents of course and 4 attestations from the F	PBL "Computer architecture"		
Assignment for the Following	General Engineering Science (German program): Specialis	ation Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semeste	er): Specialisation Computer Science: Elective C	Compulsory	
	Computer Science: Specialisation Computer and Software	Engineering: Elective Compulsory	-	
	General Engineering Science (English program): Specialis	ation Computer Science: Compulsory		
	General Engineering Science (English program, 7 semeste		ompulsory	
	Computational Science and Engineering: Specialisation Co	· · ·	· •	

Course L0793: Computer Architect	ıre
Тур	Lecture
Hrs/wk	2
CP	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



Module M0971: Operating S	Systems			
Courses				
Courses		T	Hara fords	0.5
Title		Тур	Hrs/wk	CP
Operating Systems (L1153) Operating Systems (L1154)		Lecture Recitation Section (small)	2	3 3
	Prof. Volker Turau		2	5
Module Responsible				
Admission Requirements	None			
Recommended Previous	 Object-oriented programming, algorithms, and data 	structures		
Knowledge	Procedural programming			
	Experience in using tools related to operating syste	ms such as editors, linkers, compilers		
	Experience in using C-libraries			
Educational Objectives	After taking part successfully, students have reached the fo	lowing learning results		
Professional Competence				
Knowledge				•
	transitions, and paraphrase the architectural variants of operating systems. They give examples of existing operating systems and architectures. The participants of the course write concurrent programs using threads, conditional variables and semaphores. Students can be a set of the course write concurrent programs using threads, conditional variables and semaphores. Students can be a set of the course write concurrent programs using threads, conditional variables and semaphores. Students can be a set of the course write concurrent programs using threads, conditional variables and semaphores. Students can be a set of the course write concurrent programs using threads, conditional variables and semaphores.			
	variants of realizing a file system. Students explain at least	inree dillerent scheduling algorithms.		
Skills	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.		
Deve en el Commedence				
Personal Competence				
Social Competence				
Autonomy	lade and the Product Transford Objects Transford Lade as 50			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points Examination	Written exam			
Examination Examination duration and scale	90 min			
Assignment for the Following Curricula	General Engineering Science (German program): Specialis General Engineering Science (German program, 7 semest		Compulsory	
Gurricula	Computer Science: Core qualification: Compulsory	er). Specialisation Computer Science: Elective	, compuisory	
	General Engineering Science (English program): Specialis	ation Computer Science: Compulsory		
	General Engineering Science (English program). Specialis		Compulsory	
	Computational Science and Engineering: Specialisation Co		Compulsory	
	Technomathematics: Specialisation II. Informatics: Elective			
	resinentationates. opecialisation il. informatics. Elective	comparativ		

Course L1153: Operating Systems		
Тур	Lecture	
Hrs/wk		
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 Manual B. Sc. "General Engineering Science (German program)"

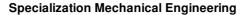


Module M0727: Stochastics	S			
A				
Courses				
Title		Тур	Hrs/wk	CP
Stochastics (L0777) Stochastics (L0778)		Lecture Recitation Section (small)	2	4
Module Responsible	Prof. Marko Lindner	Recitation Section (Smail)	2	2
Admission Requirements	none			
Recommended Previous	libite			
Knowledge	Calculus			
Knowledge	Discrete algebraic structures (combinatorics)			
	Propositional logic			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence		ų		
Knowledge	Students can explain the main definitions of probability, and	they can give basic definitions of mo	deling elements (ra	ndom variables, events.
C C	dependence, independence assumptions) used in discrete and		÷ ,	
	describe characteristic notions such as expected values, varian	nce, standard deviation, and moments.	Students can define	decision problems and
	explain algorithms for solving these problems (based on the ch	ain rule or Bayesian networks). Algorith	nms, or estimators as	they are caller, can be
	analyzed in terms of notions such as bias of an estimator, etc. St	udent can describe the main ideas of st	ochastic processes a	nd explain algorithms for
	solving decision and computation problem for stochastic processe	es. Students can also explain basic statist	ical detection and est	imation techniques.
Skills	Students can apply algorithms for solving decision problems, a	and they can justify whether approxima	tion techniques are	good enough in various
	application contexts, i.e., students can derive estimators and judge	e whether they are applicable or reliable.		
Personal Competence				
Social Competence	- Students are able to work together (e.g. on their regular home we	ork) in heterogeneously composed teams	s (i.e., teams from diffe	rent study programs and
	background knowledge) and to present their results appropriately	, , ,	(,	
Autonomy	- Students are capable of checking their understanding of complex	concepts on their own. They can specify	y open questions pred	cisely and know where to
	get help in solving them.			
	- Students can put their knowledge in relation to the contents of ot	ner lectures.		
	- Students have developed sufficient persistence to be able to wor	k for longer periods in a goal-oriented m	anner 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): Spe	ecialisation Computer Science: Compulse	ory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation C	computer Science: Compulsory		
	General Engineering Science (English program, 7 semester): Spe	cialisation Computer Science: Compulso	ory	
	Computational Science and Engineering: Core qualification: Com	pulsory		
	Logistics and Mobility: Specialisation Engineering Science: Election	ve Compulsory		



Typ Hrs/wk	
	2
CP	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
	Fractical 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	
Literature	1. 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	



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.

In-depth knowledge in Engineering applications, especially in the selected subject area of specialisation (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.
 The ability to work scientifically and to expand their specialized knowledge independently.

Hrs/wk

2

3

3

2

СР

2

2

1

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

 Courses

 Title
 Typ

 Embodiment Design and 3D-CAD (L0268)
 Lecture

 Mechanical Design Project I (L0595)
 Practical Course

 Mechanical Design Project II (L0592)
 Practical Course

 Team Project Design Methodology (L0267)
 Problem-based Learning

 Module Responsible
 Prof. Dieter Krause

 Admission Requirements
 None

Module M0598: Mechanical Engineering: Design

Team Project Design Methodology (L0267	r) Problem-based Learning 2 1
Module Responsible	Prof. Dieter Krause
Admission Requirements	None
Recommended Previous	
Knowledge	Fundamentals of Mechanical Engineering Design
	Mechanics Fundamentals of Matarials Science
	Fundamentals of Materials Science Production Engineering
	• Froduction 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. considering load situation, materials and manufacturing 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 autonomously,
	dimension (calculate) used components,
	 use methods to design and solve engineering design tasks systamtically and solution-oriented,
	apply creativity techniques in teams.
Personal Competence	
Social Competence	After passing the module, students are able to:
	 develop and evaluate solutions in groups including making and documenting decisions,
	moderate the use of scientific methods,
	 present and discuss solutions and technical drawings within groups,
	reflect the own results in the work groups of the course.
Autonomy	Students are able
	 to estimate their level of knowledge using activating methods 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: Compulsory
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): 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 Enviromental Engineering: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory
	General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Computery
	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 Energy and Enviromental Engineering: Compulsory
	Mechanical Engineering: Core qualification: Compulsory
	Mechatronics: Core qualification: Compulsory
1	1



Naval Architecture: Core qualification: Compulsory

L

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 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.	

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 		



Courses				
		Tur	l lue kule	0.0
Title	95	Typ	Hrs/wk 2	CP 2
Fundamentals of Materials Science I (L10 Fundamentals of Materials Science II (Adv	vanced Ceramic Materials, Polymers and Composites) (L0506)	Lecture	2	2
Physical and Chemical Basics of Materials		Lecture	2	2
Module Responsible				
Admission Requirements	None			
Recommended Previous	Highschool-level physics, chemistry und mathematics			
Knowledge	Highschool-level physics, chemistry and mathematics			
Kilowiedge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge				
	Fundamental knowledge here means specifically the issues of at	omic structure, microstructure, pha	ase diagrams, phase transfor	rmations, corrosion
	mechanical properties. The students know about the key aspect	s of characterization methods for	materials and can identify r	elevant approache
	characterizing specific properties. They are able to trace materials	phenomena back to the underlyin	ng physical and chemical laws	s of nature.
01.78	The students are able to the second data when a second state the	and all the states to all and all second set	Laure of a store Materials also	
Skills	The students are able to trace materials phenomena back to the			
	mechanical properties such as strength, ductility, and stiffness, ch			
	solidification, precipitation, or melting. The students can explain t		conditions and the materials n	microstructure, and
	can account for the impact of microstructure on the material's beha	wor.		
Personal Competence				
Personal Competence Social Competence	-			
	-			
Social Competence	- - Independent Study Time 96, Study Time in Lecture 84			
Social Competence Autonomy	- - Independent Study Time 96, Study Time in Lecture 84 6			
Social Competence Autonomy Workload in Hours				
Social Competence Autonomy Workload in Hours Credit points	6			
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	6 Written exam 180 min	inerray and Enviromental Engineer	ring: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E			
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation M	lechanical Engineering: Compulse	ory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E	Nechanical Engineering: Compulso Diomedical Engineering: Compulso	ory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N	Aechanical Engineering: Compulso biomedical Engineering: Compulso laval Architecture: Compulsory	ory ory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Specialisation N	Mechanical Engineering: Compulso liomedical Engineering: Compulso laval Architecture: Compulsory scialisation Mechanical Engineerin	ory ory ng: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Specialisation Specialisation N General Engineering Science (German program, 7 semester): Specialisation Specialisation N	Aechanical Engineering: Compulso isomedical Engineering: Compulso laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin	ory ory ng: Compulsory ig: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	Aechanical Engineering: Compulso diomedical Engineering: Compulso laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con	ory ory ng: Compulsory ig: Compulsory mpulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	Aechanical Engineering: Compulso iomedical Engineering: Compulso laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con icialisation Energy and Enviromen	ory ory ng: Compulsory ig: Compulsory mpulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe Energy and Environmental Engineering: Core qualification: Comp	Aechanical Engineering: Compulso liomedical Engineering: Compulso laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con icialisation Energy and Enviromen ulsory	ory ory ng: Compulsory ng: Compulsory mpulsory ntal Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe Energy and Environmental Engineering: Core qualification: Comp General Engineering Science (English program): Specialisation E	Acchanical Engineering: Compulse liomedical Engineering: Compulse laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con icialisation Energy and Enviromen ulsory nergy and Enviromental Engineeri	ory ory ng: Compulsory ng: Compulsory mpulsory ntal Engineering: Compulsory ing: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe 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 M	Mechanical Engineering: Compulse iomedical Engineering: Compulse laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con icialisation Energy and Enviromen ulsory nergy and Enviromental Engineeri echanical Engineering: Compulse	ory ory ng: Compulsory ngulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation R General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation M General Engineering Science (English program): Specialisation B	Acchanical Engineering: Compulse iomedical Engineering: Compulse laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con icialisation Energy and Enviromen ulsory nergy and Enviromental Engineeri echanical Engineering: Compulse iomedical Engineering: Compulse	ory ory ng: Compulsory ngulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation B General Engineering Science (German program): Specialisation B General Engineering Science (German program): Specialisation P General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation M General Engineering Science (English program): Specialisation B General Engineering Sc	Aechanical Engineering: Compulse iomedical Engineering: Compulse laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con icialisation Energy and Enviromen ulsory nergy and Enviromental Engineeri echanical Engineering: Compulse iomedical Engineering: Compulsory aval Architecture: Compulsory	ory ory ng: Compulsory ngulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation B General Engineering Science (German program): Specialisation B General Engineering Science (German program): Specialisation P General Engineering Science (German program): Specialisation P General Engineering Science (German program): Specialisation P General Engineering Science (German program, 7 semester): Spe General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation B General Engineering Science (English program): Specialisation B General Engineering Science (English program): Specialisation N General Engineering Sc	Aechanical Engineering: Compulse iomedical Engineering: Compulse laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con icialisation Energy and Enviromen ulsory nergy and Enviromental Engineering: comedical Engineering: Compulso iomedical Engineering: Compulso aval Architecture: Compulsory cialisation Mechanical Engineering	ory ory ng: Compulsory ngulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory yry g: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation R General Engineering Science (German program, 7 semester): Spe General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation B General Engineering Science (English program): Specialisation B General Engineering Science (English program): Specialisation N General Engineering Science (English program): Specialisation N General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Spe	Aechanical Engineering: Compulse iomedical Engineering: Compulse laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con icialisation Energy and Enviromen ulsory nergy and Enviromental Engineering echanical Engineering: Compulso iomedical Engineering: Compulsory cialisation Mechanical Engineering cialisation Biomedical Engineering cialisation Biomedical Engineering	ory ory ng: Compulsory mpulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory yry g: Compulsory g: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe 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 M General Engineering Science (English program): Specialisation N General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Spe	Aechanical Engineering: Compulsa iomedical Engineering: Compulsa laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con icialisation Energy and Enviromen ulsory nergy and Enviromental Engineering echanical Engineering: Compulso iomedical Engineering: Compulso aval Architecture: Compulsory cialisation Mechanical Engineering cialisation Biomedical Engineering cialisation Naval Architecture: Com	ory ory ng: Compulsory mpulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory ory g: Compulsory g: Compulsory mpulsory	,
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation B General Engineering Science (English program): Specialisation N General Engineering Science (English program): Specialisation N General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Spe	Aechanical Engineering: Compulse iomedical Engineering: Compulse laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con- icialisation Energy and Enviromen- ulsory nergy and Enviromental Engineering echanical Engineering: Compulso iomedical Engineering: Compulso aval Architecture: Compulsory cialisation Mechanical Engineering cialisation Naval Architecture: Con- cialisation Naval Architecture: Com- cialisation Naval Architecture: Com- cialisation Naval Architecture: Com- cialisation Energy and Enviroment	ory ory ng: Compulsory mpulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory ory g: Compulsory g: Compulsory mpulsory	,
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe 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 B General Engineering Science (English program): Specialisation N General Engineering Science (English program): Specialisation N General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Spe Cogistics and Mobility: Specialisation Engineering Science: Election	Aechanical Engineering: Compulse iomedical Engineering: Compulse laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con- icialisation Energy and Enviromen- ulsory nergy and Enviromental Engineering echanical Engineering: Compulso iomedical Engineering: Compulso aval Architecture: Compulsory cialisation Mechanical Engineering cialisation Naval Architecture: Con- cialisation Naval Architecture: Com- cialisation Naval Architecture: Com- cialisation Naval Architecture: Com- cialisation Energy and Enviroment	ory ory ng: Compulsory mpulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory ory g: Compulsory g: Compulsory mpulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation M General Engineering Science (English program): Specialisation N General Engineering Science (English program): Specialisation N General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Spe	Aechanical Engineering: Compulse iomedical Engineering: Compulse laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con- icialisation Energy and Enviromen- ulsory nergy and Enviromental Engineering echanical Engineering: Compulso iomedical Engineering: Compulso aval Architecture: Compulsory cialisation Mechanical Engineering cialisation Naval Architecture: Con- cialisation Naval Architecture: Com- cialisation Naval Architecture: Com- cialisation Naval Architecture: Com- cialisation Energy and Enviroment	ory ory ng: Compulsory mpulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory ory g: Compulsory g: Compulsory mpulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe 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 B General Engineering Science (English program): Specialisation N General Engineering Science (English program): Specialisation N General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Spe Cogistics and Mobility: Specialisation Engineering Science: Election	Aechanical Engineering: Compulse iomedical Engineering: Compulse laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con- icialisation Energy and Enviromen- ulsory nergy and Enviromental Engineering echanical Engineering: Compulso iomedical Engineering: Compulso aval Architecture: Compulsory cialisation Mechanical Engineering cialisation Naval Architecture: Con- cialisation Naval Architecture: Com- cialisation Naval Architecture: Com- cialisation Naval Architecture: Com- cialisation Energy and Enviroment	ory ory ng: Compulsory mpulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory ory g: Compulsory g: Compulsory mpulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe 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 B General Engineering Science (English program): Specialisation N General Engineering Science (English program): Specialisation N General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Spe Logistics and Mobility: Specialisation Engineering Science: Election Mechanical Engineering: Core qualification: Compulsory	Aechanical Engineering: Compulse iomedical Engineering: Compulse laval Architecture: Compulsory icialisation Mechanical Engineerin icialisation Biomedical Engineerin icialisation Naval Architecture: Con- icialisation Energy and Enviromen- ulsory nergy and Enviromental Engineering echanical Engineering: Compulso iomedical Engineering: Compulso aval Architecture: Compulsory cialisation Mechanical Engineering cialisation Naval Architecture: Con- cialisation Naval Architecture: Com- cialisation Naval Architecture: Com- cialisation Naval Architecture: Com- cialisation Energy and Enviroment	ory ory ng: Compulsory mpulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory ory g: Compulsory g: Compulsory 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				
CP	2			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28			
Lecturer	Prof. Bodo Fiedler, Prof. Gerold Schneider			
Language				
Cycle	oSe			
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 M0610: Electrical M	lachines				
Courses					
Title		Тур	Hrs/wk	CP	
Electrical Machines (L0293)		Lecture	3	4	
Electrical Machines (L0294)		Recitation Section (large)	2	2	
Module Responsible	Prof. Günter Ackermann				
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	learning results			
Professional Competence					
Knowledge	Students can to draw and explain the basic principles of electric a	nd magnetic fields.			
	They can describe the function of the standard types of electric	machines and present the correspon	ding equations and c	haracteristic curves Fr	
	typically used drives they can explain the major parameters of the		•		
	······································				
Skills	Students arw able to calculate two-dimensional electric and magn	etic fields in particular ferromagnetic cir	cuits with air gap. For	this they apply the usua	
	methods of the design auf electric machines.				
	They can calulate the operational performance of electric machines from their given characteristic data and selected quantities 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 magn	atic fields for applications. They are a	ble to analyse indepe	endently the operation	
	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 E	nergy and Enviromental Engineering: C	compulsory		
Curricula	General Engineering Science (German program): Specialisation N				
	General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering: Ele	ective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory				
	Energy and Environmental Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Mechanical Engineering: Elective Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Spe		ctive Compulsory		
	Computational Science and Engineering: Specialisation Engineer				
	Logistics and Mobility: Specialisation Engineering Science: Electiv	e 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	Prof. Günter Ackermann
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	Prof. Günter Ackermann
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 M0865: Fundamen	als of Production and Quality Ma	anagement			
Courses					
Title		Тур	Hrs/wk	CP	
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	e reached the following learning results			
Professional Competence					
Knowledge	Students are able to explain the contents 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	1 Lecture 56			
Credit points	6				
Examination	Written exam				
Examination duration and scale	180 Minuten				
Assignment for the Following	General Engineering Science (German prog	gram): Specialisation Mechanical Engineering: Elective C	ompulsory		
Curricula	General Engineering Science (German prog	gram, 7 semester): Specialisation Mechanical Engineering	g: Elective Compulsory		
	General Engineering Science (English prog	gram): Specialisation Mechanical Engineering: Elective Co	ompulsory		
	General Engineering Science (English prog	gram, 7 semester): Specialisation Mechanical Engineering	: Elective Compulsory		
	Logistics and Mobility: Specialisation Engin	eering Science: Elective Compulsory			
	Mechanical Engineering: Core qualification	: Elective Compulsory			

Course L0925: Production Process Organization				
Тур	Lecture			
Hrs/wk				
CP	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			
	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			
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 		



Nodule M0672: Signals and	l Systems
courses	
itle	Typ Hrs/wk CP
ignals and Systems (L0432) ignals and Systems (L0433)	Lecture 3 4 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 expec
	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 sign
	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. T
Civilio -	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.
Describer	the impact of Lin systems on the signal properties in time and requercy 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 lect
	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 Process Engineering: Computering
	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: Compulse
	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 Engineer
	Compulsory
	Computer Science: Core qualification: Compulsory
	Electrical Engineering: Core qualification: 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 Engineer
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Compulsory



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems				
Hrs/wk	3			
CP	4			
Workload in Hours	lependent Study Time 78, Study Time in Lecture 42			
Lecturer	Prof. Gerhard Bauch			
Language	DE/EN			
Cycle	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		
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 M0680: Fluid Dynamics					
Courses					
Title		Тур	Hrs/wk	CP	
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 r	nechanics and thermodynamics.			
Knowledge					
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results			
Professional Competence					
Knowledge	Students will have the required sound knowledge to explain	the general principles of fluid engineering a	nd physics of fluids. S	Students can scientifica	
	outline the rationale of flow physics using mathematical mod				
	engineering devices.		,		
Chille			al aveta ma Tha la shi		
Skills				re enables the student	
	carry out all necessary theoretical calculations for the fluid dyn	famile design of engineering devices of a set	entinc level.		
Personal Competence					
Social Competence	The students are able to discuss problems and jointly develop	o solution strategies.			
Autonomy	The students are able to develop solution strategies for complex problems self-consistent and crtically analyse 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): Specialisat	ion Mechanical Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisat	ion Biomedical Engineering: Compulsory			
	General Engineering Science (German program): Specialisat	ion Naval Architecture: Compulsory			
	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 Naval Architecture: Compuls	ory		
	General Engineering Science (English program): Specialisati	on Mechanical Engineering: Compulsory			
	General Engineering Science (English program): Specialisati				
	General Engineering Science (English program): Specialisation Naval Architecture: 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 Naval Architecture: Compulsory				
	Computational Science and Engineering: Specialisation Engi	neering Sciences: Elective Compulsory			
	Mechanical Engineering: Core qualification: Compulsory				
	Naval Architecture: Core qualification: Compulsory				
	Technomathematics: Specialisation III. Engineering Science:				

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 with out 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	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	



Medule M0024, Advensed	Materiala			
Module M0934: Advanced	waterials			
Courses				
Title		Тур	Hrs/wk	CP
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 materials along with their application	ns in technology, in pa	rticular metallic, cerami
	polymeric, semiconductor, modern composite materia	als (biomaterials) and nanomaterials.		
01.71	The state of the s	and the second		
Skills	The students will be able to select material configurations according to the technical needs and, if necessary, to design new materials considering architectural principles from the micro- to the macroscale. The students will also gain an overview on modern materials science, which enables them			
		÷	nodern materials scienc	e, which enables them
	select optimum materials combinations depending or	n the technical applications.		
Personal Competence				
Social Competence	The students are able to present solutions to specialists and to develop ideas further.			
Autonomy	The students are able to			
	 assess their own strengths and weaknesses. 			
	 define tasks independently. 			
	• deine tasks independently.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 8	4		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Sp	ecialisation Mechanical Engineering: Elective Con	npulsory	
Curricula	General Engineering Science (German program, 7 s	emester): Specialisation Mechanical Engineering:	Elective Compulsory	
	General Engineering Science (English program): Sp			
	General Engineering Science (English program, 7 se			
	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
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	See interlocking course
Literature	See interlocking course



Module M0960: Mechanics	IV (Kinetics II, Oscillations, Analytical Mechar	nics, Multibody Systems)		
Courses				
Title		Tup	Hrs/wk	CP
	alytical Mechanics, Multibody Systems) (L1137)	Typ Lecture	3	3
	alytical Mechanics, Multibody Systems) (L1137) alytical Mechanics, Multibody Systems) (L1138)	Recitation Section (small)	2	2
	alytical Mechanics, Multibody Systems) (L1139)	Recitation Section (large)	- 1	- 1
Module Responsible				
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		0 0		
Knowledge	The students can			
Ū.				
	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 / mech	anical analysis and model formation, and ap	ply it to the context of	their own problems;
	 apply basic methods to engineering problems; 			
	 estimate the reach and boundaries of the methods and 	extend them to be applicable to wider problem	em sets.	
Personal 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	weaknesses and to organize their time and le	arning based on thos	e.
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	on Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisat	on Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 semester)	Specialisation Mechanical Engineering: Con	mpulsory	
	General Engineering Science (German program, 7 semester)	Specialisation Biomedical Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester)	Specialisation Naval Architecture: Compulse	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):			
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester):	Specialisation Naval Architecture: Compulso	ory	
	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	ary Course Core Studies: Elective Compulsor	У	

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	
	- Basics of continuum vibrations	
	- Introduction into Modeling of 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).	

Literature See interlocking course



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 (Kinet	ics 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	



Module M0956: Measureme	ent Technology for Mechanical and Proc	ess Fngineers		
Module M0350. Measureme	and rectinology for mechanical and Proc			
Courses				
ītle		Тур	Hrs/wk	CP
Practical Course: Measurement and Contr	rol Systems (L1119)	Laboratory Course	2	2
Measurement Technology for Mechanical	and Process Engineers (L1116)	Lecture	2	3
leasurement 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 e	ngineering		
Knowledge				
Educational Objectives	After taking part successfully, students have reached th	ne following learning results		
Professional Competence				
Knowledge	Students are able to name the most important fundme	entals of the Measurement Technology (Quantities	and Units Uncertaint	v Calibration Static
	Dynamic Properties of Sensors and Systems).			y, ouloratori, olato
	They can outline the most important measuring metho	ds for different kinds of quantities to be maesured (Electrical Quantities,	Temperature, mechar
	quantities, Flow, Time, Frequency).			
	The second se		and the A	
	They can describe important methods of chemical Ana	lysis (Gas Sensors, Spectroscopy, Gas Chromatogr	apny)	
Skills	Students can select suitable measuring methods to give	ren problems and can use refering measurement de	vices in practice.	
	The students are able to orally explain issues in the s	ubject area of measurement technology and solution	n annroachas as we	Il as place the issues
	the right context and application area.	ubject area of measurement technology and solution	n approaches as we	
	the right context and application area.			
Personal Competence				
Social Competence	Students can arrive at work results in groups and docu	ment them in a common report.		
Autonomy	Students are able to familiarize themselves with new n	neasurement technologies.		
, atoming		louden of the control		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70	0		
Credit points	6			
Examination	Written exam			
Examination duration and scale	105 minutes			
Assignment for the Following	General Engineering Science (German program): Spe	cialisation Energy and Environmental Engineering: (compulsory	
Curricula	General Engineering Science (German program): Spe		ompaisory	
ourrioud	General Engineering Science (German program): Spe			
	General Engineering Science (German program): Spe			
			ainooring: Compulse	n/
	General Engineering Science (German program, 7 ser			чy
	General Engineering Science (German program, 7 ser			
	General Engineering Science (German program, 7 ser			
	General Engineering Science (German program, 7 ser	, 1 6 6 1	ulsory	
	Energy and Environmental Engineering: Core qualifica			
	General Engineering Science (English program): Spec		ompulsory	
	General Engineering Science (English program): Spec			
	General Engineering Science (English program): Spec			
	General Engineering Science (English program): Spec			
	General Engineering Science (English program, 7 sen	, , , , , , , , , , , , , , , , , , , ,		У
	General Engineering Science (English program, 7 sen	nester): Specialisation Mechanical Engineering: Co	mpulsory	
	General Engineering Science (English program, 7 sen	nester): Specialisation Biomedical Engineering: Cor	npulsory	
	General Engineering Science (English program, 7 sen	nester): Specialisation Process Engineering: Compu	Ilsory	
	Mechanical Engineering: Core qualification: Compulse	ory		
	Mechatronics: Core qualification: Compulsory			



ourse L1119: Practical Course: Me	asurement and Control Systems
Тур	Laboratory Course
Hrs/wk	2
CP	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 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., Wissenschaftlicht 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 Blockschaftbildern 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, 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
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Sven Krause DE
Cycle	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.

Course L1118: Measurement Techn	ourse 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		Тур	Hrs/wk	CP
ntroduction to Management (L0880) Project Entrepreneurship (L0882)		Lecture Problem-based Learning	3	3 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 fol	llowing learning results		
Professional Competence				
Knowledge	After taking this module, students know the important basi Marketing and Innovation, and also to Investment and Cont		nagement, from Plan	ning and Organisation
	 explain the differences between Economics and Ma field of Management 	anagement and the sub-disciplines in Managen	nent and to name impo	ortant definitions from t
	explain the most important aspects of and goals in N	Management and name the most important aspe	ects of entreprneurial	projects
	describe and explain basic business functions as	production, procurement and sourcing, supply	chain management,	organization and hum
	ressource management, information management, i	innovation management and marketing		
	explain the relevance of planning and decision matrix	aking in Business, esp. in situations under mu	Itiple objectives and	uncertainty, and expl
	some basic methods from mathematical Finance	te de se star III e se su elle se de		
	 state basics from accounting and costing and select 	ted controlling methods.		
Skills	Students are able to analyse business units with res Entrepreneurship project in a team. In particular, they are a		ctives, strategies etc	.) and to carry out
	 analyse Management goals and structure them app 	propriately		
	 analyse management goals and structure ment app analyse organisational and staff structures of compa 			
	 apply methods for decision making under multiple of 			
	 analyse production and procurement systems and E 			
	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 c	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 entre 	preneurship project and write a coherent repor	t on the project	
	 to apply their knowledge norm the locate to an entre to communicate appropriately and 	spreneursnip project and write a concretit 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 	s		
	 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): Specialis	о о і ,		
Curricula	General Engineering Science (German program): Specialis			
	General Engineering Science (German program): Specialis			
	General Engineering Science (German program): Specialis	1 0 0 1 3		
	General Engineering Science (German program): Specialis	o, o o	1	
	General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis		mpulsory	
	General Engineering Science (German program): Specialis			
	General Engineering Science (German program): Specialis			
	General Engineering Science (German program), oppolate		oulsory	
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste	, , , , , , , , , , , , , , , , , , , ,		
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste		-	
	General Engineering Science (German program, 7 semeste	er): Specialisation Bioprocess Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste	er): Specialisation Energy and Enviromental En	gineering: Compulsor	у
	General Engineering Science (German program, 7 semester	er): Specialisation Mechanical Engineering, Fo	cus Mechatronics: Cor	npulsory
		or): Specialization Mechanical Engineering For	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester	er). Specialisation Mechanical Engineering, roo		1 3
	General Engineering Science (German program, 7 semeste General Engineering Science (German program, 7 semeste	, , , , , , , , , , , , , , , , , , , ,	cus Aircraft Systems E	
		er): Specialisation Mechanical Engineering, For		ngineering: Compulso
	General Engineering Science (German program, 7 semeste	er): Specialisation Mechanical Engineering, For		ngineering: Compulso
	General Engineering Science (German program, 7 semeste General Engineering Science (German program, 7 sem	er): Specialisation Mechanical Engineering, Foo nester): Specialisation Mechanical Engineering	g, Focus Materials ir	ngineering: Compulso



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
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 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 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 Enviromental 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: 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



ourse L0880: Introduction to Management		
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. Wolfgar	
	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.	



Focus Biomechanics

The specialization Biomechanics in the field of study Mechanical Engineering of the course of study General Engineering Science enables a consecutive study of the master Biomechanics an economical oriented master study.

Module M1277: MED I: Introduction to Anatomy Courses Title Тур 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 common diseases; they can explain the 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 competently in conversations on the topic and acquire the relevant knowledge themselves Workload in Hours Independent Study Time 62, Study Time in Lecture 28 Credit points Examination Written exam Examination duration and scale 90 minutes General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory Assignment for the Following 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: Specialisation III. Engineering Science: Elective Compulsory



Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Tobias Lange	
Language	DE	
Cycle	SoSe	
Content	General Anatomy	
	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	



ourses				
tle		Тур	Hrs/wk	CP
roduction to Radiology and Radiation TI	nerapy (L0383)	Lecture	2	3
Module Responsible	Prof. Ulrich Carl			
Admission Requirements	None			
Recommended Previous Knowledge	None			
Educational Objectives	After taking part successfully, students have re	ached the following learning results		
Professional Competence				
Knowledge	-			
	Therapy			
	The students can distinguish different types of	currently used equipment with respect to its use in rad	liation therapy.	
The students can explain complex treatment plans used in radiation therapy in interdisciplinary conte			exts (e.g. surgery, internal me	edicine).
	The students can describe the patients' passage from their initial admittance through to follow-up care.			
	Diagnostics			
	The students can illustrate the technical base concepts of projection radiography, including angiography and mammography, as w imaging techniques (CT, MRT, US).			ny, as well as section
	The students can explain the diagnostic as we	Il as therapeutic use of imaging techniques, as well as	s the technical basis for those	etechniques.
	The students can choose the right treatment m	ethod depending on the patient's clinical history and r	needs.	
	The student can explain the influence of techn	ical errors on the imaging techniques.		
	The student can draw the right conclusions ba	sed on the images' diagnostic findings or the error pro	otocol.	
Skills				
Skills	Therapy			
	The students can distinguish surative and pall	iative situations and motivate why they came to that or	nalusion	
	The students can distinguish curative and pair	iative situations and motivate why they came to that co	inclusion.	
	The students can develop adequate therapy co	oncepts and relate it to the radiation biological aspects	S.	
	The students can use the therapeutic principle	(effects vs adverse effects)		
	The students can distinguish different kinds of energy needed in that situation (irradiation pla	of radiation, can choose the best one depending on nning).	the situation (location of the	tumor) and choose t
	The student can assess what an individual ps social services, psycho-oncology).	sychosocial service should look like (e.g. follow-up tre	eatment, sports, social help g	roups, self-help grou
	Diagnostics			
	The students can suggest solutions for repairs	of imaging instrumentation after having done error an	alvses.	
	The students can classify results of imaging te pathophysiology.	echniques according to different groups of diseases b	ased on their knowledge of	anatomy, pathology a
Deve and Commetence				
Personal Competence Social Competence				
	The students can assess the special social situ	uation of tumor patients and interact with them in a pro	fessional way.	
	The students are aware of the special, often fe	ar-dominated behavior of sick people caused by diag	nostic and therapeutic meas	ures and can meet the
	appropriately.		· ·	
Autonomy				
	The students can apply their new knowledge a	ind skills to a concrete therapy case.		
	The students can introduce younger students t	to the clinical daily routine.		
	The students are able to access anatomical	knowledge by themselves, can participate compete	antly in conversations on the	e topic and acquire t
	relevant knowledge themselves.	knowledge by menselves, can paracipate compete		
Workload in Hours	Independent Study Time 62, Study Time in Lea	nturo 29		
Credit points	3	JUIE 20		
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following		m): Specialisation Mechanical Engineering, Focus Bio		
Curricula		um): Specialisation Biomedical Engineering: Compulso um, 7 semester): Specialisation Biomedical Engineerin	•	
		um, 7 semester): Specialisation Biomedical Engineerin um, 7 semester): Specialisation Mechanical Engineerin		npulsory
	Electrical Engineering: Specialisation Medical	Technology: Elective Compulsory		
		m): Specialisation Mechanical Engineering, Focus Bio		
		 m): Specialisation Biomedical Engineering: Compulso m, 7 semester): Specialisation Mechanical Engineerin 		npulsory
		,		

Module Manual B. Sc. "General Engineering Science (German program)"



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	
CP	3	
Workload in Hours		
Lecturer	Prof. Ulrich Carl, Prof. Thomas Vestring	
Language Cycle		
Content		
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	



Modulo M0660, Numerical	Inthomatica I			
Module M0662: Numerical	Mathematics I			
Courses				
Title		Тур	Hrs/wk	CP
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	Mathematik I + II for Engineering Students (german or e	nglish) or Analysis & Linear Algebra I + I	I for Technomathematiciz	ans
Knowledge	basic MATLAB knowledge	······································		
	-			
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	Students are able to			
	 name numerical methods for interpolation, integration 	, least squares problems, eigenvalue p	roblems, nonlinear root	finding problems and
	explain their core ideas,			
	 repeat convergence statements for the numerical method 			
	 explain aspects for the practical execution of numerical 	methods with respect to computational a	nd storage complexitx.	
Skille	Students are able to			
SKIIS				
	 implement, apply and compare numerical methods usin 	ng MATLAB,		
	 justify the convergence behaviour of numerical method 	s with respect to the problem and solution	1 algorithm,	
	 select and execute a suitable solution approach for a g 	ven problem.		
Personal Competence				
Social Competence	Students are able to			
	work together in heterogeneously composed teams (i.			dge), explain theoretic
	foundations and support each other with practical aspe	cts regarding the implementation of algor	itrims.	
Autonomy	Students are capable			
	 to assess whether the supporting theoretical and practi- 	cal excercises are better solved individua	ally or in a team.	
	 to assess their individual progess and, if necessary, to a 		,	
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): Specialisatio			
Curricula	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation			icos: Compulsoni
	General Engineering Science (German program): Specialisatio		als in Engineering Scien	ices. Compulsory
	General Engineering Science (German program, 7 semester):		ulsorv	
	General Engineering Science (German program, 7 semeste			Engineering Science
	Compulsory			
	General Engineering Science (German program, 7 semester):	Specialisation Biomedical Engineering: (Compulsory	
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering,	Focus Biomechanics: Co	mpulsory
	Bioprocess Engineering: Specialisation A - General Bioproces	s Engineering: Elective Compulsory		
	Computer Science: Specialisation Computational Mathematics			
	Electrical Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program): Specialisatio		de la companya de la	
	General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program): Specialisatio			ces: Compulsory
	General Engineering Science (English program, 7 semester): S			Engineering Original
	General Engineering Science (English program, 7 semeste	n). Specialisation Mechanical Enginee	ing, rocus materials in	Engineering Science
	Compulsory General Engineering Science (English program, 7 semester): 5	Specialisation Biomedical Engineering: C	ompulsory	
	General Engineering Science (English program, 7 semester): 3 General Engineering Science (English program, 7 semester): 5			moulsory
	actional Engineering colorise (English program, 7 settlester).	specialization moonanical Engineenny, i	SSSS Diomocriamos. OUI	
	Computational Science and Engineering: Core qualification: C	ompulsorv		



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 f ür Ingenieure und Naturwissenschaftler, Springer

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	



	. "General Engineering Science (Ger				
Module M0684: Heat Trans	fer				
Courses					
litle		Тур	Hrs/wk	CP	
leat Transfer (L0458)		Lecture	3	4	
leat 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 follo	owing 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 develo	p an approach.			
Autonomy	The students are able to develop a complex problem colf or	pointent and analyze the requite in a critical w	av A qualified evolution	no with other students	
Autonomy	The students are able to develop a complex problem self-co given.	insistent and analyse the results in a childar w	ay. A quained exchan	ge with other students	
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): Specialisa	ation Mechanical Engineering, Focus Biomech	anics: Compulsory		
_ · · ·	General Engineering Science (German program): Specialisa		Sustama: Compulsory		
Curricula		ation Mechanical Engineering, Focus Energy S	systems. Compulsory		
Curricula	General Engineering Science (German program): Specialisa		systems. Compulsory		
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program): Specialisa	ation Biomedical Engineering: Compulsory		ering: Compulsory	
Curricula		ation Biomedical Engineering: Compulsory ation Mechanical Engineering, Focus Theoreti	cal Mechanical Engine		
Curricula	General Engineering Science (German program): Specialisa	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Fo	cal Mechanical Engine cus Energy Systems: C	ompulsory	
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program, 7 semester	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Fo	cal Mechanical Engine cus Energy Systems: C	ompulsory	
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program, 7 semester General Engineering Science (German program, 7 semest	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Fo ster): Specialisation Mechanical Engineering	cal Mechanical Engine cus Energy Systems: C , Focus Theoretical M	ompulsory	
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program, 7 semester General Engineering Science (German program, 7 semest Compulsory	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Fo ster): Specialisation Mechanical Engineering): Specialisation Biomedical Engineering: Co	cal Mechanical Engine cus Energy Systems: C , Focus Theoretical M	ompulsory	
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program, 7 semester General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Focus ter): Specialisation Mechanical Engineering (): Specialisation Biomedical Engineering: Con- tion Biomedical Engineering: Compulsory	cal Mechanical Engine cus Energy Systems: C , Focus Theoretical M mpulsory	ompulsory	
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program, 7 semester General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory tition Mechanical Engineering, Focus Theoreti '): Specialisation Mechanical Engineering, Fo- ster): Specialisation Mechanical Engineering '): Specialisation Biomedical Engineering: Co- tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomech	cal Mechanical Engine cus Energy Systems: C , Focus Theoretical M mpulsory anics: Compulsory	ompulsory	
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program, 7 semester General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory tition Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Fo- ster): Specialisation Mechanical Engineering (): Specialisation Biomedical Engineering: Co- tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomech tion Mechanical Engineering, Focus Energy S	cal Mechanical Engine cus Energy Systems: C , Focus Theoretical M mpulsory anics: Compulsory ystems: Compulsory	ompulsory lechanical Engineerir	
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program, 7 semester General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory tition Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Fo- ster): Specialisation Mechanical Engineering (): Specialisation Biomedical Engineering: Co- tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomech tion Mechanical Engineering, Focus Energy S tion Mechanical Engineering, Focus Theoretic	cal Mechanical Engine cus Energy Systems: C , Focus Theoretical M mpulsory anics: Compulsory ystems: Compulsory al Mechanical Engine	ompulsory lechanical Engineerin ering: Compulsory	
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program, 7 semester General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory tition Mechanical Engineering, Focus Theoreti (): Specialisation Mechanical Engineering, Fo- ster): Specialisation Mechanical Engineering (): Specialisation Biomedical Engineering: Co- tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomech tion Mechanical Engineering, Focus Energy S tion Mechanical Engineering, Focus Theoretic (): Specialisation Mechanical Engineering, Focus	cal Mechanical Engine cus Energy Systems: C , Focus Theoretical M mpulsory anics: Compulsory ystems: Compulsory ystems: Compulsory al Mechanical Engine us Energy Systems: C	ompulsory lechanical Engineerin ering: Compulsory pmpulsory	
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program, 7 semester General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory tition Mechanical Engineering, Focus Theoreti (): Specialisation Mechanical Engineering, Fo- ster): Specialisation Mechanical Engineering (): Specialisation Biomedical Engineering: Co- tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomech tion Mechanical Engineering, Focus Energy S tion Mechanical Engineering, Focus Theoretic (): Specialisation Mechanical Engineering, Focus	cal Mechanical Engine cus Energy Systems: C , Focus Theoretical M mpulsory anics: Compulsory ystems: Compulsory ystems: Compulsory al Mechanical Engine us Energy Systems: C	ompulsory lechanical Engineerin ering: Compulsory pmpulsory	
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program, 7 semester General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 semester	ation Biomedical Engineering: Compulsory tition Mechanical Engineering, Focus Theoreti (): Specialisation Mechanical Engineering, Focus Engineering (): Specialisation Biomedical Engineering, Focus Biomech tion Mechanical Engineering, Focus Energy S tion Mechanical Engineering, Focus Theoretic (): Specialisation Mechanical Engineering, Focus (): Specialisation Mechanical Engineering	cal Mechanical Engine cus Energy Systems: C , Focus Theoretical M mpulsory anics: Compulsory ystems: Compulsory ystems: Compulsory al Mechanical Engine us Energy Systems: C , Focus Theoretical M	ompulsory lechanical Engineerin ering: Compulsory pmpulsory	
Curricula	General Engineering Science (German program): Specialisa General Engineering Science (German program, 7 semester General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 semester	tion Biomedical Engineering: Compulsory tition Mechanical Engineering, Focus Theoreti (): Specialisation Mechanical Engineering, Fo- ster): Specialisation Mechanical Engineering (): Specialisation Biomedical Engineering: Co- tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomech tion Mechanical Engineering, Focus Energy S tion Mechanical Engineering, Focus Theoretic (): Specialisation Mechanical Engineering, Focus ter): Specialisation Mechanical Engineering (): Specialisation Biomedical Engineering: Cor	cal Mechanical Engine cus Energy Systems: C , Focus Theoretical M mpulsory anics: Compulsory ystems: Compulsory ystems: Compulsory al Mechanical Engine us Energy Systems: C , Focus Theoretical M	ompulsory lechanical Engineerin ering: Compulsory pmpulsory	

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 M1279: MED II: Intr	oduction to Biochemistry and Mol	ecular Biology		
Courses				
ïtle		Тур	Hrs/wk	CP
nte htroduction to Biochemistry and Molecula	r Biology (I 0386)	Lecture	2	3
Module Responsible	Prof. Hans-Jürgen Kreienkamp	Leoture	2	5
	- · ·			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have re	eached the following learning results		
Professional Competence				
Knowledge	The students can			
	 describe basic biomolecules; 			
	 explain how genetic information is cod 	ed in the DNA:		
	explain the connection between DNA a			
		···· • • · • • • • • • • • • • • • • •		
Skills	The students can			
	 recognize the importance of molecular 	parameters for the course of a disease.		
	describe selected molecular-diagnosti			
	explain the relevance of these procedu			
	• explain the relevance of these proceed			
Personal Competence				
Social Competence	The students can participate in discussions in	research and medicine on a technical level.		
Autonomy	The students can develop understanding of to	pics from the course, using technical literature, by thems	selves.	
Workload in Hours	Independent Study Time 62, Study Time in Le	cture 28		
Credit points	3			
Examination	Written exam			
Examination duration and scale	60 minutes			
Assignment for the Following	General Engineering Science (German progra	am): Specialisation Mechanical Engineering, Focus Bion	nechanics: Compulsory	
Curricula	General Engineering Science (German progra	am): Specialisation Biomedical Engineering: Compulsor	у	
	General Engineering Science (German progra	am, 7 semester): Specialisation Biomedical Engineering	: Compulsory	
	General Engineering Science (German progra	am, 7 semester): Specialisation Mechanical Engineering	, Focus Biomechanics: Co	mpulsory
	Electrical Engineering: Specialisation Medical	Technology: Elective Compulsory		
	General Engineering Science (English progra	m): Specialisation Mechanical Engineering, Focus Biom	echanics: Compulsory	
	General Engineering Science (English progra	m): Specialisation Biomedical Engineering: Compulsory	1	
	General Engineering Science (English progra	m, 7 semester): Specialisation Mechanical Engineering,	Focus Biomechanics: Co	mpulsory
	General Engineering Science (English progra	m, 7 semester): Specialisation Biomedical Engineering:	Compulsory	
	Mechanical Engineering: Specialisation Biom	echanics: Compulsory		
	Biomedical Engineering: Specialisation Mana	gement and Business Administration: Elective Compuls	ory	
	Biomedical Engineering: Specialisation Artific	ial Organs and Regenerative Medicine: Elective Compu	lsory	
	Biomedical Engineering: Specialisation Medic	cal Technology and Control Theory: Elective Compulsory	ý	
	Biomedical Engineering: Specialisation Impla	nts and Endoprostheses: Elective Compulsory		
	Technomathematics: Core qualification: Election	ve Compulsory		
	Technomathematics: Specialisation III. Engine			

Course L0386: Introduction to Biochemistry and Molecular Biology		
Тур	Lecture	
Hrs/wk	2	
CP	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					
litle		Тур	Hrs/wk	CP	
mplants and Fracture Healing (L0376)		Lecture	2	3	
Module Responsible	Prof. Michael Morlock				
Admission Requirements	None	None			
Recommended Previous	It is recommended to participate in "Introduction into A	natomie" before attending "Implants and Fractur	e Healing".		
Knowledge					
Educational Objectives	After taking part successfully, students have reached t	he following learning results			
Professional Competence					
Knowledge	The students can describe the different ways how bon	es heal, and the requirements for their existence	э.		
	The students can name different treatments for the spi	ne and hollow bones under given fracture morpl	hologies.		
Skills	The students can determine the forces acting within th	The students can determine the forces acting within the human body under quasi-static situations under specific assumptions.			
Personal Competence					
	The students can, in groups, solve basic numerical modeling tasks for the calculation of internal forces.				
Autonomy	The students can, in groups, solve basic numerical mo	odeling tasks for the calculation of internal forces	S.		
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): Spe	cialisation Mechanical Engineering, Focus Bion	nechanics: Compulsory		
Curricula	General Engineering Science (German program): Spe	cialisation Biomedical Engineering: Compulsor	у		
	General Engineering Science (German program, 7 se	mester): Specialisation Mechanical Engineering	, Focus Biomechanics: Co	mpulsory	
	General Engineering Science (German program, 7 se	mester): Specialisation Biomedical Engineering	: Compulsory		
	General Engineering Science (English program): Spe	cialisation Biomedical Engineering: Compulsory	1		
	General Engineering Science (English program): Spe	cialisation Mechanical Engineering, Focus Biom	echanics: Compulsory		
	General Engineering Science (English program, 7 ser	nester): Specialisation Mechanical Engineering,	, Focus Biomechanics: Cor	npulsory	
	General Engineering Science (English program, 7 ser	nester): Specialisation Biomedical Engineering:	Compulsory		
	Mechanical Engineering: Specialisation Biomechanic	s: Compulsory			
	Biomedical Engineering: Specialisation Artificial Orga	ns and Regenerative Medicine: Elective Compu	lsory		
	Biomedical Engineering: Specialisation Implants and	Endoprostheses: Elective Compulsory			
	Biomedical Engineering: Specialisation Medical Tech	nology and Control Theory: Elective Compulsory	ý		
	Biomedical Engineering: Specialisation Management	and Business Administration: Elective Compuls	ory		
	Technomathematics: Specialisation III. Engineering Se	cience: Elective Compulsory			



Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
	Prof. Michael Morlock
	DE
Cycle	WiSe Topics to be covered include:
	1. 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



Module M1280: MED II: Intr	oduction to Physiology			
	Substantia Fingeleiogy			
Courses				
Title		Тур	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	earning results		
Professional Competence				
Knowledge	The students can			
	 describe the basics of the energy metabolism; 			
	describe physiological relations in selected fields of muscle	heart/circulation, neuro- and se	nsory physiology.	
Skills	The students can describe the effects of basic bodily functions (s	ensorv. transmission and proce	ssing of information, develop	ment of forces and vita
	functions) and relate them to similar technical systems.	· · · , , · · · · · · · · · · · · · · · · · ·		
Personal Competence	,			
Social Competence				
p	The students can find solutions to problems in the field of physiolog		cal.	
Autonomy	The students can derive answers to questions arising in the course	and other physiological areas, u	using technical literature, by th	emselves.
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 M	echanical Engineering. Focus B	iomechanics: Compulsorv	
Curricula	General Engineering Science (German program): Specialisation Bi			
	General Engineering Science (German program, 7 semester): Spe	cialisation Biomedical Engineeri	ng: Compulsory	
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineer	ing, Focus Biomechanics: Con	npulsory
	Electrical Engineering: Specialisation Medical Technology: Elective	Compulsory		
	General Engineering Science (English program): Specialisation Me	chanical Engineering, Focus Bi	omechanics: Compulsory	
	General Engineering Science (English program): Specialisation Bi	omedical Engineering: Compuls	ory	
	General Engineering Science (English program, 7 semester): Spec	ialisation Mechanical Engineeri	ng, Focus Biomechanics: Com	pulsory
	General Engineering Science (English program, 7 semester): Spec	ialisation Biomedical Engineerir	ng: Compulsory	
	Mechanical Engineering: Specialisation Biomechanics: Compulsor	у		
	Biomedical Engineering: Specialisation Medical Technology and C		•	
	Biomedical Engineering: Specialisation Management and Busines		•	
	Biomedical Engineering: Specialisation Artificial Organs and Rege		pulsory	
	Biomedical Engineering: Specialisation Implants and Endoprosthe	ses: Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Electi	ve 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	



Module M1332: BIO I: Expe	rimental Methods in Biomechanics			
Courses				
Title		Тур	Hrs/wk	CP
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 Fr	rakturheilung" before attending "Experimentelle M	lethoden".	
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 bor	nes heal, and the requirements for their existence	•	
	The students can name different treatments for the sp	ine and hollow bones under given fracture morph	ologies.	
	The students can describe different measurement tec	build use for forces and movements, and choose th	a adequate technique for	a diven task
		aniques for forces and movements, and choose if	le adequate technique for	a given task.
Skills	The students can describe the basic handling of seve	eral experimental techniques used in biomechanic	cs.	
Personal Competence				
Social Competence	The students can, in groups, solve basic experimenta	al tasks		
oobial oompetenee		a dono.		
Autonomy	The students can, in groups, solve basic experimenta	il tasks.		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	8		
Credit points	3			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Sp	ecialisation Mechanical Engineering, Focus Biom	echanics: Compulsory	
Curricula	General Engineering Science (German program): Sp	ecialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 se	emester): Specialisation Mechanical Engineering,	Focus Biomechanics: Cor	npulsory
	General Engineering Science (German program, 7 se	emester): Specialisation Biomedical Engineering:	Compulsory	
	General Engineering Science (English program): Spe	ecialisation Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Spe	ecialisation Mechanical Engineering, Focus Biome	echanics: Compulsory	
	General Engineering Science (English program, 7 se	mester): Specialisation Mechanical Engineering,	Focus Biomechanics: Com	npulsory
	General Engineering Science (English program, 7 se	mester): Specialisation Biomedical Engineering:	Compulsory	
	Mechanical Engineering: Specialisation Biomechanic	cs: Compulsory		
	Biomedical Engineering: Specialisation Artificial Orga	ans and Regenerative Medicine: Elective Compuls	sory	
	Biomedical Engineering: Specialisation Implants and	Endoprostheses: Elective Compulsory		
	Biomedical Engineering: Specialisation Medical Tech	nnology and Control Theory: Elective Compulsory		
	Biomedical Engineering: Specialisation Managemen	t and Business Administration: Elective Compulso	ory	
	Technomathematics: Specialisation III. Engineering S	Science: Elective Compulsory		

Course L0377: Experimental Metho	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 specialization energy engineering in the field of study Mechanical Engineering of the course of study General Engineering Science enables a consecutive study of the master Energy Engineering or an economical oriented master study.

	Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	CP
Advanced Mechanical Engineering Design	n II (L0264)	Lecture	2	2
Advanced Mechanical Engineering Design	n II (L0265)	Recitation Section (large)	2	1
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous		~~		
Knowledge	 Fundamentals of Mechanical Engineering Desig Mechanics 	11		
	Fundamentals of Materials Science			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge				
Momeage				
	explain complex working principles and function	is of machine elements and of basic elements of fl	uidics,	
	explain requirements, selection criteria, application	ion scenarios and practical examples of complex	machine elements,	
	 indicate the background of dimensioning calculation 	ations.		
01.114	After second and the second data should be a second state of the s			
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of covere	d machine elements,		
	 transfer knowledge learned in the module to new 	w requirements and tasks (problem solving skills),		
	 recognize the content of technical drawings and 			
	 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	r 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				
Credit points				
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Spec	ialisation Mechanical Engineering, Focus Energy	Systems: Compulsory	
Curricula	General Engineering Science (German program): Spec	ialisation Mechanical Engineering, Focus Aircraft	Systems Engineering:	Compulsory
	General Engineering Science (German program): Spec	ialisation Mechanical Engineering, Focus Materia	Is in Engineering Scier	nces: Compulsory
	General Engineering Science (German program): Speci	ialisation Mechanical Engineering, Focus Mechat	ronics: Compulsory	
	General Engineering Science (German program): Speci	ialisation Mechanical Engineering, Focus Product	t Development and Pro	duction: Compulsory
	General Engineering Science (German program): Speci	ialisation Mechanical Engineering, Focus Theoret	tical Mechanical Engin	eering: Compulsory
	General Engineering Science (German program, 7 sem	ester): Specialisation Mechanical Engineering, Fc	ocus Aircraft Systems E	Engineering: Compuls
	General Engineering Science (German program, 7 s			
	Compulsory	, ,	0,	0 0
	General Engineering Science (German program, 7 sem	ester): Specialisation Mechanical Engineering. Fo	ocus Mechatronics: Co	mpulsorv
	General Engineering Science (German program, 7 se			
	Compulsory		, 10000110000012010	
		amostar); Specialization Machanical Engineerin	a Focus Theoretical (Mochanical Engineer
	General Engineering Science (German program, 7 se		g, rocus meoretical l	moonanical Engineer
	Compulsory General Engineering Science (German program, 7 sem	notor): Spanialization Machanical Facine at the	Pour Riomashanian O	mpulcon
	5 5 K 1 5 /	, 1		1
	General Engineering Science (German program, 7 sem			Compulsory
	General Engineering Science (English program): Specia			
	General Engineering Science (English program): Speci			
	General Engineering Science (English program): Specia			ices: Compulsory
	General Engineering Science (English program): Speci	alisation Mechanical Engineering, Focus Mechatr	onics: Compulsory	
	General Engineering Science (English program): Speci	alisation Mechanical Engineering, Focus Product	Development and Proc	duction: Compulsory
	General Engineering Science (English program): Speci	alisation Mechanical Engineering, Focus Theoreti	ical Mechanical Engine	eering: Compulsory
	Centeral Engineering Celence (English program). Opeon			
	General Engineering Science (English program), open	ester): Specialisation Mechanical Engineering. Fo	Cus Aircrait Systems E	ngineering: Compuls
	General Engineering Science (English program, 7 seme	, , ,	-	
	General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 s	, , ,	-	
	General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 s Compulsory	semester): Specialisation Mechanical Engineerin	ng, Focus Materials ir	n Engineering Scien
	General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 s	semester): Specialisation Mechanical Engineerin ester): Specialisation Mechanical Engineering, Fo	ng, Focus Materials ir	n Engineering Scien



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
Typ	
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.
	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 Mechanic	ourse 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	



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
Language	DE
Cycle	WiSe
Content	Advanced Mechanical Engineering Design I & II
	Lecture
	Fundamentals of the following machine elements:
	Chinear 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.
	 Enhulhung in die Dirk-Normen, Nien, M., Teubher-Verlag. Konstruktionslehre, Pahl, G.; Beitz, W., 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 Mechanic	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				
Courses				
Title		Тур	Hrs/wk	CP
Computational Fluid Dynamics I (L0235)		Lecture	2	3
Computational Fluid Dynamics I (L0419)		Recitation Section (large)	2	3
Module Responsible	Prof. Thomas Rung			
Admission Requirements	None			
Recommended Previous	Mathematical Methods for Engineers			
Knowledge	 Fundamentals of Differential/integral calculus and series e: 	roansions		
		panoiono		
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The students are able to list the basic numerics of partial differentia	al equations.		
Skills	The students are able develop appropriate numerical integratio	n 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 th	əm.		
Autonomy	The students can independently analyse approaches to solving sp	ecific 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 N	lechanical Engineering, Focus Energy S	Systems: Compulsory	
Curricula	General Engineering Science (German program): Specialisation N	laval Architecture: Compulsory		
	General Engineering Science (German program, 7 semester): Spe	cialisation Naval Architecture: Compuls	ory	
	General Engineering Science (German program, 7 semester): Spe		cus Energy Systems: I	Elective Compulsory
	General Engineering Science (English program): Specialisation N			
	General Engineering Science (English program): Specialisation M			
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe	cialisation Mechanical Engineering, Foc	us Energy Systems: E	lective Compulsory
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Elect Technomathematics: Specialisation III. Engineering Science: Elect			
	reennenationation operation in Lighteening orlence. Elect	we compulsory		

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 Computation of potential flows Introduction of finite-differences Approximation of convective, diffusive and transient transport processes Formulation of boundary conditions and initial conditions Assembly and solution of algebraic equation systems Facets of weighted -residual approaches Finite volume methods Basics of grid generation 	
Literature	Ferziger and Peric: Computational Methods for Fluid Dynamics, Springer	



Course L0419: Computational Fluid	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 St	eam Power Plants			
Courses				
Title		Тур	Hrs/wk	CP
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				
Recommended Previous				
Knowledge	 "Technical Thermodynamics I and II" 			
	 "Heat Transfer" 			
	"Fluid Mechanics"			
Educational Objectives	After taking part successfully, students have reached the followir	ng learning results		
Professional Competence				
Knowledge	The students can evaluate the development of the electricity de	mand and the energy conversion routes	in the thermal power pl	ant, describe the vario
	types of power plant and the layout of the steam generator bl	ock. They are also able to determine th	ne operation characteri	stics of the power pla
	Additionally they can describe the exhaust gas cleaning appa	ratus and the combination possibilities	of conventional fossil-fu	uelled power plants w
	solar thermal and geothermal power plants or plants equipped v	vith Carbon Capture and Storage.		
	The students have basic knowledge about the principles, operat	ion and design of turbomachinery		
or ""				
Skills	The students will be able, using theories and methods of the en			
	and construction of gas and steam power plants, to identify ba			
	solutions. Through analysis of the problem and exposure to the			
	the capability and methodology to develop realistic optimal conc the students become the ability to follow better the deliberation:		•	
	supply and environmental protection).	s on the electricity mix composition with	in the energy-political th	langle (economy, sec
	supply and environmental protection).			
	Within the framework of the exercise the students learn the use	of the specialised software suite EBSILC	ON Professional TM . With	h this tool small practi
	tasks are solved with the PC, to highlight aspects of the design a	nd development of power plant cycles.		
	The students are able to do simplified calculations on turbomach	ninery either as part of a plant, as single c	component or at stage le	evel.
Personal Competence			,	
Social Competence				
	power plant in this region. The students will obtain first-hand e technical and political issues.	experience with a power plant in operation	ion and gain insignts in	no the connicts betwe
Autonomy	The students assisted by the tutors will be able to develop alo	no simple simulation models and run w	ith those seenarie anal	vege in this manner
Autonomy	theoretical and practical knowledge from the lecture is cons			
	conditions highlighted. The students are able independently t			
	quantities and characteristic curves.		or otoani potror plana	
	1			
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	General Engineering Science (German program): Specialisation	Energy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Energy	Systems: Compulsory	
	General Engineering Science (German program, 7 semester): S	pecialisation Energy and Enviromental E	ingineering: Compulsor	у
	General Engineering Science (German program, 7 semester): S	pecialisation Mechanical Engineering, Fe	ocus Energy Systems: E	Elective Compulsory
	Energy and Environmental Engineering: Core qualification: Corr	npulsory		
	General Engineering Science (English program): Specialisation	Energy and Enviromental Engineering: 0	Compulsory	
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Energy	Systems: Compulsory	
	General Engineering Science (English program, 7 semester): Sp	pecialisation Energy and Enviromental En	ngineering: Compulsory	/
	General Engineering Science (English program, 7 semester): Sp	pecialisation Mechanical Engineering, Fo	ocus Energy Systems: E	lective Compulsory
	Mechanical Engineering: Specialisation Energy Systems: Comp	ulsory		



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



Course L0210: Gas and Steam Powe	er Plants
Тур	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:
	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 the
	lecture hall exercise. The challenges in plant operation from interconnecting conventional power plants and renewable energy sources are discussed
	and the technical options for providing security of supply and network stability are presented, also under consideration of cost effectiveness. In this
	critical review, focus is especially placed on the compatibility of the different solutions with the environment and climate. With this, the awareness for the
	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 tasks are
	solved on the PC, to highlight aspects of the design and development of power plant cycles. The students present their results orally and can afterward
	ask questions and get feedback. The course work has a positive effect on the students final grade.
Literature	
	Skripte Kalida: Kraft und Arbeitsmasschinge
	Kalide: Kraft- und Arbeitsmaschinen
	Thomas, H.J.: Thermische Kraftanlagen. Springer-Verlag, 1985 Strauß, K.: Kraftwarkstochnik, Saringer-Verlag, 2006
	Strauß, K.: Kraftwerkstechnik. Springer-Verlag, 2006 Kunglowerd Bilinger: Energiatedesity Optioner Verlag, 1000
	Kugeler und Phlippen: Energietechnik. Springer-Verlag, 1990 T. Paka (key black bestellt for the formation of the for
	T. Bohn (Hrsg.): Handbuchreihe Energie, Band 7: Gasturbinenkraftwerke, Kombikraftwerke, Heizkraftwerke und Industriekraftwerke, Technischer
	Verlag Resch / Verlag TUV Rheinland



Module M0684: Heat Transf	er	
Courses		
Title	Typ 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 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 approach.	
Autonomy	The students are able to develop a complex problem self-consistent and analyse the results in a critical way. A qualified exchange with other stude	nts 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 Mechanical Engineering, Focus Biomechanics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory	
	General Engineering Science (German program): Specialisation Biomedical Engineering: 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 Energy Systems: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer	əring
	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): Specialisation Mechanical Engineering, Focus Energy Systems: 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 Energy Systems: Compulsory	a rice of
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Compulsory	;mg
	Compulsory General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
	Mechanical Engineering: Specialisation Energy Systems: Compulsory	
	Mechanical Engineering: Specialisation Theoretical Mechanical Engineering: Compulsory	
	montaneat Eighteening, opeolatioation mooreheat montanear Eighteening, Outputabry	

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 M1022: Reciprocat	ing Machinery			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Reciprocating Engines a	nd Turbomachinery - Part Reciprocating Engines (L0633)	Lecture	1	1
Fundamentals of Reciprocating Engines a	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	g learning results		
Professional Competence				
Knowledge Skills Personal Competence Social Competence	As a result of the part module "Fundamentals of Reciprocating Machinery", the students are able to reflect fundamentals regarding power and working 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. The students are skilled to employ basic and detail knowledge regarding reciprocating machinery, their selection and operation. They are further able to assess, analyse and solve technical and operational problems and to perform mechanical and thermodynamic design.			
Autonomy	The students are able to communicate and cooperate in a profess The widespread scope of gained knowledge enables the student			
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 Energy S	Systems: Compulsory	
Curricula	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering, Foc	cus Energy Systems: (Compulsory
	General Engineering Science (English program): Specialisation I			
	General Engineering Science (English program, 7 semester): Spe	ecialisation Mechanical Engineering, Foc	us Energy Systems: C	Compulsory



Тур	Lecture
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	Verbrennungsmotoren o 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
	 Kolbenverdichter Thermodynamik des Kolbenverdichters Einteilung und Verwendung
	Kolbenpumpen Prinzip der Kolbenpumpen Einteilung und Verwendung
Literature	A. Urlaub: Verbrennungsmotoren

ourse 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 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	

Ξ



Focus Aircraft Systems Engineering

	conomical oriented master study. Mechanical Engineering Design			
Courses			Hus fods	0.5
Fitle	a II (1.0254)	Typ Lecture	Hrs/wk 2	CP 2
Advanced Mechanical Engineering Design Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Desigr	ı I (L0263)	Recitation Section (large)	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 follo	owing learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	• explain complex working principles and functions of	machine elements and of basic elements of fl	uidics,	
	explain requirements, selection criteria, application s	cenarios and practical examples of complex r	machine elements,	
	indicate the background of dimensioning calculations	S.		
Skills	After passing the module, students are able to:			
Onno	The passing the module, stateme are able to.			
	accomplish dimensioning calculations of covered ma			
	 transfer knowledge learned in the module to new req 			
	 recognize the content of technical drawings and sche 	∍matic sketches,		
	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 acq Students are able to acquire additional knowledge 		tant a g by using the	video recordingo of
	 Students are able to acquire additional knowledge lectures. 	and to recapitulate poony understood con	tent e.g. by using the	video recordings or
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120			
	General Engineering Science (German program): Specialisa			
Curricula	0 0 (10 / 1	• •		
	General Engineering Science (German program): Specialisa	o o ,	0 0	ices: Compulsory
	General Engineering Science (German program): Specialisa			duction: Compulsory
	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 seme			• • •
	Compulsory		ig, i ocao matemate n	
	General Engineering Science (German program, 7 semester	r): Specialisation Mechanical Engineering, Fc	ocus Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semes	ter): Specialisation Mechanical Engineering	, Focus Product Devel	lopment and Product
	Compulsory			
	General Engineering Science (German program, 7 semes	ster): Specialisation Mechanical Engineering	g, Focus Theoretical M	Mechanical Engineer
	Compulsory			
	General Engineering Science (German program, 7 semester	r): Specialisation Mechanical Engineering, Fo	ocus Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester	, ,		Compulsory
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program): Specialisa			ces: Compulsory
	Conorol Engineering Original (English and a) Original	uon wechanicai Engineering, Focus Mechatro		
	General Engineering Science (English program): Specialisa	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory		
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa	tion Mechanical Engineering, Focus Theoreti	cal Mechanical Engine	ering: Compulsory
	General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester	tion Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Foc	cal Mechanical Engine cus Aircraft Systems Er	eering: Compulsory ngineering: Compulso
	General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 seme	tion Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Foc	cal Mechanical Engine cus Aircraft Systems Er	eering: Compulsory ngineering: Compulso
	General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 seme Compulsory	tion Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Foc ster): Specialisation Mechanical Engineerin	cal Mechanical Engine cus Aircraft Systems Er ng, Focus Materials ir	eering: Compulsory ngineering: Compulso n Engineering Scien
	General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 seme	tion Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Foc ster): Specialisation Mechanical Engineering): Specialisation Mechanical Engineering, Foc	cal Mechanical Engine cus Aircraft Systems Er ng, Focus Materials ir cus Mechatronics: Con	eering: Compulsory ngineering: Compulso n Engineering Scien npulsory
	General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 semester	tion Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Foc ster): Specialisation Mechanical Engineering): Specialisation Mechanical Engineering, Foc	cal Mechanical Engine cus Aircraft Systems Er ng, Focus Materials ir cus Mechatronics: Con	eering: Compulsory ngineering: Compulso n Engineering Scien npulsory
	General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 semester	tion Mechanical Engineering, Focus Theoreti): Specialisation Mechanical Engineering, Foc ster): Specialisation Mechanical Engineering): Specialisation Mechanical Engineering, Foc ter): Specialisation Mechanical Engineering,	cal Mechanical Engine cus Aircraft Systems Er ng, Focus Materials in cus Mechatronics: Con Focus Product Devel	eering: Compulsory ngineering: Compulsor n Engineering Scien npulsory lopment and Product



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) 	
	Calculations of hydrostatic systems (fluidics)	
Literature		
	 Dubbel, Taschenbuch f ür 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	
	Come Malate Baalat 20 appellation memory	

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



Tvn	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	
	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 Crark coord
	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

Course L0263: Advanced Mechanic	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				
Title		Тур	Hrs/wk	CP
Advanced Mechanical Design Project (L02		Practical Course	4	6
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	Mechanical Engineering: Design			
Knowledge	Advanced Mechanical Engineering Design			
Educational Objectives	After taking part successfully, students have reached the following learn	ning results		
Professional Competence	Affective standards and the standards are shifted as			
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 possibil	ities,		
	 explain guidelines for designing for function and manufacturing 	,		
	explain advanced use-oriented knowledge of machine element	IS.		
Skills	After passing the module, students are able to:			
	 analyze complex tasks and develop principle solutions using sk 	ketches,		
	 convert principle solutions into a detailed design, 			
	 use methods to design and solve engineering design tasks system 			
	create a technical documentation including all necessary techn		functions of the system,	
	 document calculations of selected machine elements clearly an 	id in detail.		
Personal Competence				
Social Competence	After passing the module, students are able to:			
	 present and discuss solutions and technical drawings within group to the solution of the solution of the solution. 	oups,		
	reflect the own results in the work groups of the course			
Autonomy	After passing the module, students are able to:			
		4h		
	 independently solve complex design projects, while motivating to independently solve problems. 	inemserves, acquiring necessar	y knowledge and selectin	g appropriate metrod
	 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 Mech	anical Engineering, Focus Aircra	aft Systems Engineering: (Compulsory
Curricula	General Engineering Science (German program): Specialisation Mech	anical Engineering, Focus Produ	uct Development and Proc	duction: Compulsory
	General Engineering Science (German program): Specialisation Mech	anical Engineering, Focus Theo	retical Mechanical Engine	ering: Compulsory
	General Engineering Science (German program, 7 semester): Speciali	sation Mechanical Engineering,	Focus Aircraft Systems Er	ngineering: Compulso
	General Engineering Science (German program, 7 semester): Speci	alisation Mechanical Engineering	ng, Focus Product Devel	opment and Production
	Compulsory			
	General Engineering Science (German program, 7 semester): Spec	cialisation Mechanical Engineer	ing, Focus Theoretical N	lechanical Engineeri
	Compulsory			
	General Engineering Science (English program): Specialisation Mecha			
	General Engineering Science (English program): Specialisation Mecha			
	General Engineering Science (English program): Specialisation Mecha		-	
	General Engineering Science (English program, 7 semester): Specialis		•	
	General Engineering Science (English program, 7 semester): Special	ausauon Mechanical Engineerir	ig, Focus Product Devel	opment and Producti
	Compulsory	inligation Mochanical Engineer	ing Ecolo Theoretical	Apphanical Engine
	General Engineering Science (English program, 7 semester): Spec	ansation mechanical Engineer	mg, rocus meoretical N	rechanical Engineeri
	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
	Lõsungsfindung
	 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, 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. Sowie weitere Bücher zu speziellen Themen



Courses				
Title		Тур	Hrs/wk	CP
Simulation and Design of Mechatronic Sys	tems (L1822)	Lecture	2	2
Simulation and Design of Mechatronic Sys	tems (L1824)	Laboratory	1	2
Simulation and Design of Mechatronic Sys	tems (L1823)	Recitation Section (large)	1	2
Module Responsible	Prof. Uwe Weltin			
Admission Requirements	None			
Recommended Previous	Fundatmentals of mechanics, control theory and electronic electron	ical engineering		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	he following learning results		
Professional Competence				
Knowledge	Students are able to describe methods and calculation	ns for design, modeling, simulation and optimizat	ion of mechatronic syste	ms.
Skills	Students are able to apply modern algorithms for r	nodeling of mechatronic systems. They can id	entify, simulate and de	sign simple systems ar
	implement those in laboratory conditions.			
Personal Competence				
Social Competence	Students are able to work goal-oriented in small mixed	d groups and present results to target groups.		
,				
Autonomy	Students are able to recognize and improve knowledg	e deficits independently.		
	With instructor assistance, students are able to evalua	te their own knowledge level and define a furthe	r course of study	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 5			
Credit points				
Examination	o Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Spe	cialisation Mechanical Engineering, Focus Mech	atronice: Compulsory	
Curricula	General Engineering Science (German program): Spe			Compulson
Guinedia	General Engineering Science (German program): Spe			
	General Engineering Science (German program, 7 se		-	
	General Engineering Science (German program, 7 set	, ,		
	General Engineering Science (German program, 7	, ,		
	Elective Compulsory	semester). Opecialisation mechanical Engineer	ing, rocus medical	Mechanical Engineerin
	General Engineering Science (English program): Spec	cialisation Mechanical Engineering, Focus Aircra	ft Systems Engineering:	Compulsory
	General Engineering Science (English program): Spec			compaisory
	General Engineering Science (English program): Spec			eering: Compulsory
	General Engineering Science (English program, 7 ser		•	
	General Engineering Science (English program, 7 ser			
	General Engineering Science (English program, 7 se		-	
	Elective Compulsory	semester). Operansatori Mechanical Engineer	ing, rocus meorelloal	inconanical Engineelin
	Mechanical Engineering: Specialisation Aircraft System	ms Engineering: Compulson		
	Mechanical Engineering: Specialisation Michair System			
	Mechanical Engineering: Specialisation Theoretical M	echanical Engineening. 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 Desig	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 Desig	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		Тур	Hrs/wk	CP
CAE-Team Project (L0271)	(19278)	Problem-based Learning	2	2
Development of Lightweight Design Produ Integrated Product Development I (L0269)		Lecture	2	2
Module Responsible	Prof. Dieter Krause	Lecture	2	2
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 fol	lowing learning results		
Professional Competence				
Knowledge	After completing the module, students are capable of:			
	• explaining the functional principle of 3D-CAD-Syste	ms, PDM- and FEM-Systems		
	describing the interaction of the different CAE-Syste	ms in the product development process		
Skills				
	After completing the module, students are able to:			
	 evaluate different CAD- and PDM-Systems with rega design an exemplary product using CAD-,PDM- and 		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 approp 	riate work packages in the framework of group	discussions	
	 Present project results as a team for instance in a pr 			
Autonomy	Students are capable of:			
Autonomy	Siddenis 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	6			
Examination	Written exam			
Examination duration and scale	90			
Assignment for the Following	General Engineering Science (German program): Specialis			
Curricula	General Engineering Science (German program): Specialis General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semest			
	Compulsory			
	General Engineering Science (English program): Specialis	ation Mechanical Engineering, Focus Aircraft Sy	stems Engineering: C	Compulsory
	General Engineering Science (English program): Specialise	• •		
	General Engineering Science (English program, 7 semeste	, 1	5	0 0 1
	General Engineering Science (English program, 7 semes	ster): Specialisation Mechanical Engineering,	Focus Product Devel	opment and Production
	Compulsory Mechanical Engineering: Specialisation Product Developm	ent and Production: Compulsory		
	Mechanical Engineering: Specialisation Aircraft Systems En			
	Product Development, Materials and Production: Technical		Compulson	



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	tweight Design Products
Тур	Lecture
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	 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	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	CP
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 thermodynamics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge	Students get a basic understanding of the structure and	design of an aircraft, as well as an overview of the	systems inside an ai	rcraft. In addition, a basic
	knowledge of the relationchips, the key parameters, roles	and ways of working in different subsystems in th	e air transport is acq	uired.
Skills	Due to the learned cross-system thinking students can gain a deeper understanding of different system concepts and their technical system			
	implementation. In addition, they can apply the learned	methods for the design and assessment of subs	systems of the air trai	nsportation system in the
	context of the overall system.			
Personal Competence				
Social Competence	Students are made aware of interdisciplinary communication in groups.			
Autonomy	Students are able to independently analyze different system concepts and their technical implementation as well as to think system 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): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory			
Curricula	General Engineering Science (German program, 7 seme	ster): Specialisation Mechanical Engineering, Foo	us Aircraft Systems E	ingineering: Compulsory
	General Engineering Science (English program): Specia	lisation Mechanical Engineering, Focus Aircraft Sy	stems Engineering:	Compulsory
	General Engineering Science (English program, 7 seme	ster): Specialisation Mechanical Engineering, Foc	us Aircraft Systems E	ngineering: Compulsory
	Logistics and Mobility: Specialisation Logistics and Mobi	ity: Elective Compulsory		
	Mechanical Engineering: Specialisation Aircraft Systems			
	meenanear Engineering. Opeolansation Allolat Systems	Engineering. Computationy		

Course L0741: Fundamentals of Aircraft Systems		
Тур	Lecture	
Hrs/wk	2	
CP	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 S	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	 Air transport as part of the global transportation system Legal basis of air transportation Safety and security aspects Aircraft basics The role of the aircraft amnufacturer The role of the aircraft operator Airport operation The principles of air traffic management Environmental aspects of air transportation 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, ISBN0-07-003077-4 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 principles Objective: Understanding and application of principle methods to practical aviation problems	
Literature	Hünnecke: Das moderne Verkehrsflugzeug von heute Flühr: Avionik und Flugsicherungstechnik	



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		Тур	Hrs/wk	CP
Advanced Mechanical Engineering Design	n II (L0264)	Lecture	2	2
Advanced Mechanical Engineering Design	n II (L0265)	Recitation Section (large)	2	1
Advanced Mechanical Engineering Design	n I (L0262)	Lecture	2	2
Advanced Mechanical Engineering Design	n I (L0263)	Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous				
Knowledge	 Fundamentals of Mechanical Engineering Design 			
	Mechanics			
	 Fundamentals of Materials Science 			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the follow	ving learning results		
Professional Competence		J J		
Knowledge	After passing the module, students are able to:			
Kilowiedge	After passing the module, students are able to:			
	explain complex working principles and functions of magnetic sectors and functions and functions of magnetic sectors and functions and functions of magnetic sectors and functions	achine elements and of basic elements of flui	dics,	
	explain requirements, selection criteria, application sca	enarios and practical examples of complex ma	achine elements,	
	indicate the background of dimensioning calculations.			
0.77				
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of covered mac	nine elements,		
	• transfer knowledge learned in the module to new requi	rements and tasks (problem solving skills),		
	recognize the content of technical drawings and schen	natic sketches,		
	• evaluate complex designs, technically.			
Personal Competence				
Social Competence	Students are able to discuss technical information in th	e lecture supported by activating methods.		
		· · · · · · · · · · · · · · · · · · ·		
Autonomy	 Students are able to independently deepen their acquire 	red knowledge in exercises		
	 Students are able to acquire additional knowledge a 		ntea by usina the	video recordings of
	lectures.	and to recapitulate poonly understood conte	int e.g. by using the	video recordings or
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): Specialisati	on Mechanical Engineering, Focus Energy S	ystems: Compulsory	
Curricula	General Engineering Science (German program): Specialisati	on Mechanical Engineering, Focus Aircraft Sy	stems Engineering:	Compulsory
	General Engineering Science (German program): Specialisati	on Mechanical Engineering, Focus Materials	in Engineering Scier	nces: Compulsory
	General Engineering Science (German program): Specialisati	on Mechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (German program): Specialisati	on Mechanical Engineering, Focus Product D	evelopment and Pro	duction: Compulsory
	General Engineering Science (German program): Specialisati	on Mechanical Engineering, Focus Theoretic	al Mechanical Engin	eering: Compulsory
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, Foc	us Aircraft Systems E	ngineering: Compulso
	General Engineering Science (German program, 7 semest	er): Specialisation Mechanical Engineering	, Focus Materials ir	n Engineering Scienc
	Compulsory			
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, Foc	us Mechatronics: Co	mpulsory
	General Engineering Science (German program, 7 semeste	r): Specialisation Mechanical Engineering, I	Focus Product Deve	lopment and Producti
	Compulsory			
	General Engineering Science (German program, 7 semeste	er): Specialisation Mechanical Engineering,	Focus Theoretical I	Mechanical Engineer
	Compulsory			
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, Foc	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, Foc	us Energy Systems: (Compulsory
	General Engineering Science (English program): Specialisation	on Mechanical Engineering, Focus Energy Sy	stems: Compulsory	
	General Engineering Science (English program): Specialisation	on Mechanical Engineering, Focus Aircraft Sy	stems Engineering: (Compulsory
	General Engineering Science (English program): Specialisation	on Mechanical Engineering, Focus Materials	in Engineering Scien	ces: Compulsory
	General Engineering Science (English program): Specialisation	on Mechanical Engineering, Focus Mechatror	nics: Compulsory	
	General Engineering Science (English program): Specialisation	• •		duction: Compulsory
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semest			
	Compulsory	, , , , , , , , , , , , , , , , , , ,	, , , , , , , , , , , , , , , , , , , ,	
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering Foo	is Mechatronics: Con	npulsorv
	General Engineering Science (English program, 7 semester).			
		, ,		,

Module Manual B. Sc. "General Engineering Science (German program)"



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 Mechanical 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		
	- Evenden entele of the following machine elements		
	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)		
1.20-00-00-00-00-00-00-00-00-00-00-00-00-0			
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



Tvn	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	
	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 Crark agar
	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

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 M0988: Structural I	Materials			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Mechanical Properties o	f 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 reach	ned the following learning results		
Professional Competence				
Knowledge	The students get to know the principles that are re-	esponsible for the mechanical behaviour of metals. T	They acquire basic knowl	egde in modelling of th
		arn about the behaviour of metals under static and d	-	-
	important welding technologies and the correspon	nding systems. They learn about the influence of weld	ing on the materials and	design.
Skills	The students know the mechanical properties of	metals and the underlying principles. They are able	e to name the influencin	a factors on the weldir
	behaviour of steel materials.			
		according to the desired mechaincal properties and		-
	÷ ,	ique and system components for a defined application	on. They are able to dime	ension weld joints withi
	design tasks.			
Personal Competence				
Social Competence	none			
Autonomy	none			
Workload in Hours	Independent Study Time 110, Study Time in Lectu	ire 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 Mater	ials in Engineering Scien	ces: Compulsory
Curricula	General Engineering Science (German program	n, 7 semester): Specialisation Mechanical Enginee	ring, Focus Materials in	Engineering Science
	Compulsory			
	General Engineering Science (English program):	Specialisation Mechanical Engineering, Focus Materi	als in Engineering Scien	ces: Compulsory
	General Engineering Science (English program	n, 7 semester): Specialisation Mechanical Enginee	ring, Focus Materials in	Engineering Science
	Compulsory			
	Mechanical Engineering: Specialisation Materials	in Engineering Sciences: Compulsory		

Course L1090: Fundamentals of Mechanical Properties of Materials		
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Norbert Huber, Dr. Erica Lilleodden	
Language	EN	
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)	
	G. Gottstein. Enysik. Gibbolagen der Materialik. (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
CP	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.
	1



Module M0662: Numerical	Mathematics I			
Courses				
		Тур	Hrs/wk	CP
Numerical Mathematics I (L0417) Numerical Mathematics I (L0418)		Lecture Recitation Section (small)	2	3 3
Module Responsible	Prof. Sabine Le Borne			-
Admission Requirements	None			
Recommended Previous	None			
Knowledge	Mathematik I + II for Engineering Students (german or basic MATLAB knowledge	english) or Analysis & Linear Algebra I + II	l for Technomathematicia	ns
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	Students are able to			
	 name numerical methods for interpolation, integratio explain their core ideas, repeat convergence statements for the numerical meth explain aspects for the practical execution of numerical 	iods,		inding problems and
Skills	Students are able to			
	 implement, apply and compare numerical methods us justify the convergence behaviour of numerical method select and execute a suitable solution approach for a generative 	ds with respect to the problem and solution	n algorithm,	
Personal Competence				
Social Competence	Students are able to			
Autonomy	 work together in heterogeneously composed teams (foundations and support each other with practical aspo Students are capable to assess whether the supporting theoretical and pract to assess their individual progess and, if necessary, to 	ects regarding the implementation of algor	ithms.	ige), exprant meere
		ask questions and seek neip.		
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): Specialisat			
Curricula	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisat		ials in Engineering Scien	ces: Compulsory
	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program, 7 semester)		-	
	General Engineering Science (German program, 7 semes	ter): Specialisation Mechanical Engineer	ring, Focus Materials in	Engineering Science
	Compulsory General Engineering Science (German program, 7 semester)	Specialization Biomodical Engineering (Compulsory	
	General Engineering Science (German program, 7 semester)			nouleon
	Bioprocess Engineering: Specialisation A - General Bioproces		ocus biomechanics. Coi	npuisory
	Computer Science: Specialisation Computational Mathematic			
	Electrical Engineering: Core qualification: Elective Compulsor			
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program): Specialisati		chanics: Compulsorv	
	General Engineering Science (English program): Specialisati			es: Compulsory
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semest		-	Engineering Science
	Compulsory	-		-
	General Engineering Science (English program, 7 semester):	Specialisation Biomedical Engineering: C	ompulsory	
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering, F	ocus Biomechanics: Com	npulsory
	Computational Science and Engineering: Core qualification: 0	Compulsory		



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
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	ence Laboratory			
Module M1009. Material Sci				
Courses				
Title		Тур	Hrs/wk	CP
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	g learning results		
Professional Competence				
Knowledge	Students are able to give a summary of the technical details of e	xperiments in the area of materials scie	ences and illustrate respe	ctive relationships. They
	are capable of describing and communicating relevant problem	ms and questions using appropriate to	echnical language. They	can explain the typical
	process of solving practical problems and present related results	5.		
Skills	The students can transfer their fundamental knowledge on mate	erial sciences to the process of solving	practical problems. The	v identify and overcome
Chine	typical problems during the realization of experiments in the con-		, practical problemor me	
	3F F			
Personal Competence				
Social Competence				
	and explain their results alone or in groups in front of a qualified	audience.		
Autonomy	Students are capable of solving problems in the context of mat	erials sciences using provided literatu	re. They are able to fill g	aps in as well as extent
	their knowledge using the literature and other sources provided	by the supervisor.		
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	Mechanical Engineering, Focus Mater	ials in Engineering Scien	ces: Compulsory
Curricula	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Produ	ct Development and Proc	duction: Compulsory
	General Engineering Science (German program, 7 semester	: Specialisation Mechanical Enginee	ring, Focus Materials in	Engineering Sciences:
	Compulsory			
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Materi	als in Engineering Scienc	ces: Compulsory
	General Engineering Science (English program): Specialisation	0 0.		1 3
	General Engineering Science (English program, 7 semester)	: Specialisation Mechanical Engineer	ring, Focus Materials in	Engineering Sciences:
	Compulsory			
	Mechanical Engineering: Specialisation Product Development a	1 3		
	Mechanical Engineering: Specialisation Materials in Engineering			
	Product Development, Materials and Production: Technical Com	plementary Course Core Studies: Elect	tive Compulsory	

Course L1088: Companion Lecture for Materials Science 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

r



undamentals of Materials Science			
olymers (L1233) olymers (L1234)	Typ Lecture Recitation Section (large)	Hrs/wk 2 1	CP 2
	Lecture	2	3
Prof. Gerold Schneider			
None			
Module "Fundamentals of Materials Science"			
Module "Materials Science Laboratory"			
Module "Advanced Materials"			
After taking part successfully, students have reached the following	learning results		
in metals, polymers and ceramics: Atomic bonds, crystal and am	orphous structures, defects , electrical	and mass transport, n	nicrostructure and phase
			should be able to critally
Independent Study Time 110, Study Time in Lecture 70			
6			
Written exam			
General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): S Compulsory General Engineering Science (English program): Specialisation M General Engineering Science (English program, 7 semester): Compulsory General Engineering Science (English program, 7 semester): S Compulsory Mechanical Engineering: Specialisation Materials in Engineering s	Specialisation Mechanical Engineering pecialisation Mechanical Engineering echanical Engineering, Focus Material Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, Sciences: Compulsory	ng, Focus Materials ir , Focus Product Devel s in Engineering Scien ng, Focus Materials ir	Engineering Sciences opment and Production ces: Compulsory Engineering Sciences
	blymers (L1233) blymers (L1234) Prof. Gerold Schneider None Module "Fundamentals of Materials Science" Module "Materials Science Laboratory" Module "Advanced Materials" After taking part successfully, students have reached the following The students are able to give an enhanced overview over the follo in metals, polymers and ceramics: Atomic bonds, crystal and am diagrams. They are capable to explain the corresponding technica The students are able to apply the appropriate physical and chemi The students are capable to understand independently the struct evaluate the profoundness of their knowledge. Independent Study Time 110, Study Time in Lecture 70 6 Written exam General Engineering Science (German program): Specialisation M General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (English program, 7 semester): Scompulsory Mechanical Engineering Science (English program, 7 semester): Scompulsory	Typ Jymers (L1233) Lecture Jymers (L1234) Rectation Section (large) Lecture Prof. Geroid Schneider None Module "Fundamentals of Materials Science" Module "Fundamentals of Materials Science" Module "Advanced Materials Science" Module "Advanced Materials" After taking part successfully, students have reached the following learning results The students are able to give an enhanced overview over the following topics in metals, polymers and ceramics: Atomic bonds, crystal and amorphous structures, defects , electrical diagrams. They are capable to explain the corresponding technical terms. The students are able to apply the appropriate physical and chemical methods for the above mentioned : The students are capable to understand independently the structure and propeties of ceramics, metals evaluate the profoundness of their knowledge. Independent Study Time 110, Study Time in Lecture 70 6 General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Material General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Material General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering Compulsory <td>Typ Hrs/wk aymers (L123) Lecture 2 bymers (L123) Rectation Section (large) 1 Lecture 2 Prof. Gerold Schneider 2 None </td>	Typ Hrs/wk aymers (L123) Lecture 2 bymers (L123) Rectation Section (large) 1 Lecture 2 Prof. Gerold Schneider 2 None



Course L1233: Enhanced Fundamen	ntals: Ceramics and Polymers
Тур	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	
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 Serüktrocknor
	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
	lonische 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 C.W.Ehrenstein:
	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
Literature	างกและกาพระหาทุน

Ξ



Focus Mechatronics

	the field of study Mechanical Engineering of the course on nted master study.			
Module M0597: Advanced	Mechanical Engineering Design			
Courses				
litle		Тур	Hrs/wk	CP
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Desigr Advanced Mechanical Engineering Desigr		Recitation Section (large) Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous				
Knowledge	Fundamentals of Mechanical Engineering Design			
	 Mechanics Fundamentals of Materials Science 			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	 explain complex working principles and functions of mac 	hine elements and of basic elements of flu	idics.	
	 explain requirements, selection criteria, application scena 			
	 indicate the background of dimensioning calculations. 		,	
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of covered maching	ne elements,		
	transfer knowledge learned in the module to new require	ements and tasks (problem solving skills),		
	 recognize the content of technical drawings and schematic 	tic sketches,		
	evaluate complex designs, technically.			
Personal Competence				
Social Competence				
Social Competence	Students are able to discuss technical information in the	lecture supported by activating methods.		
Autonomy				
Autonomy	Students are able to independently deepen their acquire	d knowledge in exercises.		
	Students are able to acquire additional knowledge and	d to recapitulate poorly understood conte	ent e.g. by using the	video recordings of
	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): Specialisation	n Mechanical Engineering, Focus Energy S	systems: Compulsory	
Curricula	General Engineering Science (German program): Specialisation	n Mechanical Engineering, Focus Aircraft S	ystems Engineering: (Compulsory
	General Engineering Science (German program): Specialisation	n Mechanical Engineering, Focus Materials	in Engineering Scien	
			in Engineering eelen	ices: Compulsory
	General Engineering Science (German program): Specialisation	n Mechanical Engineering, Focus Mechatro		ices: Compulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation		onics: Compulsory	
		n Mechanical Engineering, Focus Product [onics: Compulsory Development and Proc	duction: Compulsory
	General Engineering Science (German program): Specialisation	n Mechanical Engineering, Focus Product I n Mechanical Engineering, Focus Theoretic	onics: Compulsory Development and Proc cal Mechanical Engine	duction: Compulsory eering: Compulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester	n Mechanical Engineering, Focus Product I n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Foc	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems En	duction: Compulsory eering: Compulsory ngineering: Compulso
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester Compulsory	n Mechanical Engineering, Focus Product I n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Foc): Specialisation Mechanical Engineering	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems Er g, Focus Materials in	duction: Compulsory eering: Compulsory ngineering: Compuls Engineering Science
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester): S	n Mechanical Engineering, Focus Product I n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Foc): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, Foc	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems En g, Focus Materials in cus Mechatronics: Con	duction: Compulsory eering: Compulsory ngineering: Compuls Engineering Science npulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S	n Mechanical Engineering, Focus Product I n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Foc): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, Foc	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems En g, Focus Materials in cus Mechatronics: Con	duction: Compulsory eering: Compulsory ngineering: Compuls Engineering Science npulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester) Compulsory General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): Compulsory	n Mechanical Engineering, Focus Product I n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Foc): Specialisation Mechanical Engineering, Foc pecialisation Mechanical Engineering, Foc	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems En g, Focus Materials in cus Mechatronics: Com Focus Product Devel	duction: Compulsory bering: Compulsory ngineering: Compulso Engineering Science npulsory opment and Product
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester) Compulsory 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)	n Mechanical Engineering, Focus Product I n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Foc): Specialisation Mechanical Engineering, Foc pecialisation Mechanical Engineering, Foc	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems En g, Focus Materials in cus Mechatronics: Com Focus Product Devel	duction: Compulsory bering: Compulsory ngineering: Compuls n Engineering Scient npulsory opment and Product
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sj General Engineering Science (German program, 7 semester Compulsory General Engineering Science (German program, 7 semester): Sj General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Compulsory	n Mechanical Engineering, Focus Product I n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Foc): Specialisation Mechanical Engineering pecialisation Mechanical Engineering, specialisation Mechanical Engineering,): Specialisation Mechanical Engineering,	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems En g, Focus Materials in cus Mechatronics: Con Focus Product Devel , Focus Theoretical M	duction: Compulsory eering: Compulsory ngineering: Compuls Engineering Scient npulsory opment and Product Mechanical Engineer
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sj General Engineering Science (German program, 7 semester): Sj General Engineering Science (German program, 7 semester): Sj 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): Signeral Engineering Science (German program, 7 semester): Semester)	n Mechanical Engineering, Focus Product I n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Foc): Specialisation Mechanical Engineering pecialisation Mechanical Engineering,): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering,	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems En g, Focus Materials in cus Mechatronics: Con Focus Product Devel , Focus Theoretical M cus Biomechanics: Con	duction: Compulsory pering: Compulsory ngineering: Compuls Engineering Scient mpulsory opment and Product Mechanical Engineer mpulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S 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): S General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S	n Mechanical Engineering, Focus Product I n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, c): Specialisation Mechanical Engineering pecialisation Mechanical Engineering, c): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, Foc	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems En g, Focus Materials in Focus Mechatronics: Con Focus Product Devel Focus Theoretical M cus Biomechanics: Con cus Energy Systems: C	duction: Compulsory pering: Compulsory ngineering: Compuls Engineering Scient mpulsory opment and Product Mechanical Engineer mpulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Sj General Engineering Science (German program, 7 semester): Sj General Engineering Science (German program, 7 semester): Sj 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): Signeral Engineering Science (German program, 7 semester): Somulsory	Mechanical Engineering, Focus Product I Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Foc y Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, Specialisation Mechanical Engineering, Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, Foc pecialisation Mechanical Engineering, Foc mechanical Engineering, Focus Energy S	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems Er g, Focus Materials in Focus Product Devel Focus Product Devel Focus Theoretical M cus Biomechanics: Con cus Energy Systems: Co systems: Compulsory	duction: Compulsory gering: Compulsory ngineering: Compuls Engineering Scient mpulsory opment and Product Mechanical Engineer mpulsory Compulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S 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): S General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Product I Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Foc y Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, Focus Mechanical Engineering, Focus Energy Sy Mechanical Engineering, Focus Aircraft Sy	onics: Compulsory Development and Proc cal Mechanical Engine tus Aircraft Systems Er g, Focus Materials in Focus Product Develo Focus Product Develo Focus Theoretical M tus Biomechanics: Con tus Energy Systems: Co systems: Compulsory stems Engineering: C	duction: Compulsory sering: Compulsory ngineering: Compulsory ngineering: Compulsory opment and Product Mechanical Engineer mpulsory Compulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S 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): S General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	 Mechanical Engineering, Focus Product I in Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focus): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus mechanical Engineering, Focus Energy S Mechanical Engineering, Focus Aircraft S Mechanical Engineering, Focus Materials 	onics: Compulsory Development and Proc cal Mechanical Engine tus Aircraft Systems Er g, Focus Materials in Focus Product Devel Focus Product Devel Focus Theoretical M tus Biomechanics: Con tus Energy Systems: Co ystems: Compulsory retems Engineering: C in Engineering Science	duction: Compulsory sering: Compulsory ngineering: Compulsory ngineering: Compulsory opment and Product Mechanical Engineer mpulsory Compulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): Compulsory General Engineering Science (German program, 7 semester): Sgeneral Engineering Science (German program, 7 semester): Sgeneral Engineering Science (German program, 7 semester): General Engineering Science (German program, 7 semester): Sgeneral Engineering Science (German program, 7 semester): Sgeneral Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	 Mechanical Engineering, Focus Product I in Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focus): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus mechanical Engineering, Focus Energy S Mechanical Engineering, Focus Aircraft S Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Materials 	onics: Compulsory Development and Proc cal Mechanical Engine us Aircraft Systems Er g, Focus Materials in Focus Product Devel Focus Product Devel Focus Theoretical M us Biomechanics: Con us Energy Systems: Co ystems: Compulsory retems Engineering: Co in Engineering Scient nics: Compulsory	duction: Compulsory gering: Compulsory ngineering: Compulsory ngineering: Compulsory opment and Product Mechanical Engineer mpulsory Compulsory Compulsory ces: Compulsory
	General Engineering Science (German program): Specialisation 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): S General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	 Mechanical Engineering, Focus Product I in Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focus): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering,): Specialisation Mechanical Engineering,): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, Focus pecialisation Mechanical Engineering, Focus Mechanical Engineering, Focus Energy St Mechanical Engineering, Focus Aircraft St Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Product E 	onics: Compulsory Development and Proc cal Mechanical Engine us Aircraft Systems Er g, Focus Materials in Focus Product Devel Focus Product Devel Focus Theoretical M us Biomechanics: Con us Energy Systems: Co ystems: Compulsory ystems Engineering Co in Engineering Science nics: Compulsory Vevelopment and Proc	duction: Compulsory gering: Compulsory ngineering: Compuls n Engineering Scient npulsory opment and Product Mechanical Engineer mpulsory Compulsory Compulsory ces: Compulsory duction: Compulsory
	General Engineering Science (German program): Specialisation 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): S General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	 Mechanical Engineering, Focus Product I in Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focus): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, Focus Mechanical Engineering, Focus Energy St Mechanical Engineering, Focus Aircraft Sp Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Product E Mechanical Engineering, Focus Theoretic Mechanical Engineering, Focus Theoretic 	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems Er g, Focus Materials in cus Mechatronics: Con Focus Product Develo , Focus Theoretical M cus Biomechanics: Con cus Energy Systems: Co systems: Compulsory ystems Engineering Cient nics: Compulsory Development and Proc al Mechanical Engine	duction: Compulsory gering: Compulsory ngineering: Compulsory ngineering: Compulsory opment and Product Mechanical Engineer mpulsory Compulsory ces: Compulsory duction: Compulsory ering: Compulsory
	General Engineering Science (German program): Specialisation 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): S General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	 Mechanical Engineering, Focus Product I in Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focus): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, Focus Mechanical Engineering, Focus Energy St Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focus 	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems Eri g, Focus Materials in Focus Product Develo Focus Product Develo Focus Theoretical M cus Biomechanics: Con cus Energy Systems: Co systems: Compulsory ystems Engineering Cient nics: Compulsory Vevelopment and Proc al Mechanical Engine us Aircraft Systems En	duction: Compulsory gering: Compulsory ngineering: Compulsory ngineering: Compulsory opment and Product Mechanical Engineer mpulsory Compulsory ces: Compulsory duction: Compulsory ering: Compulsory ngineering: Compulsory
	General Engineering Science (German program): Specialisation 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): Semeral 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 General Engineering Science (English program): Specialisation	 Mechanical Engineering, Focus Product I in Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focus): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, Focus Mechanical Engineering, Focus Energy St Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focus 	onics: Compulsory Development and Proc cal Mechanical Engine cus Aircraft Systems Eri g, Focus Materials in Focus Product Develo Focus Product Develo Focus Theoretical M cus Biomechanics: Con cus Energy Systems: Co systems: Compulsory ystems Engineering Cient nics: Compulsory Vevelopment and Proc al Mechanical Engine us Aircraft Systems En	duction: Compulsory gering: Compulsory ngineering: Compulsory ngineering: Compulsory opment and Product Mechanical Engineer mpulsory Compulsory ces: Compulsory duction: Compulsory ering: Compulsory ngineering: Compulsory
	General Engineering Science (German program): Specialisation 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): S General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp	 Mechanical Engineering, Focus Product I in Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, Specialisation Mechanical Engineering, Mechanical Engineering, Focus Energy St Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Product D Mechanical Engineering, Focus Theoretic Decialisation Mechanical Engineering, Focus 	onics: Compulsory Development and Proceed al Mechanical Engine cus Aircraft Systems Eri g, Focus Materials in Focus Product Develor Focus Product Develor Focus Theoretical M cus Biomechanics: Con- cus Energy Systems: Co- systems: Compulsory ystems Engineering: Co- in Engineering Science nics: Compulsory Development and Prod al Mechanical Engine us Aircraft Systems En- g, Focus Materials in	duction: Compulsory pering: Compulsory ngineering: Compulsory ngineering: Compulsory opment and Product Mechanical Engineer mpulsory Compulsory ces: Compulsory duction: Compulsory rering: Compulsory ngineering: Compulsory ngineering: Compulsory
	General Engineering Science (German program): Specialisation 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): Semeral 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): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp	 Mechanical Engineering, Focus Product I in Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focus): Specialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Engineering, pecus Mechanical Engineering, pecialisation Mechanical Engineering, 	onics: Compulsory Development and Proceed al Mechanical Engine trus Aircraft Systems En- g, Focus Materials in Focus Product Develor Focus Product Develor Focus Theoretical M trus Biomechanics: Con- trus Energy Systems: Co- systems: Compulsory Systems: Compulsory Development and Proce al Mechanical Engine us Aircraft Systems En- g, Focus Materials in us Mechatronics: Com-	duction: Compulsory pering: Compulsory ngineering: Compulsory ngineering: Compulsory opment and Product Mechanical Engineer mpulsory Compulsory ces: Compulsory duction: Compulsory rering: Compulsory ngineering: Compulsory ngineering: Compulsory ngineering: Compulsory
	General Engineering Science (German program): Specialisation 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): Semeral 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): Specialisation General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp	 Mechanical Engineering, Focus Product I in Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, pecialisation Mechanical Engineering, Specialisation Mechanical Engineering, Mechanical Engineering, Focus Energy St Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechanical Mechanical Engineering, Focus Mechanical Engineering, Focus Mechanical Mechanical Engineering, Focus Mechanical Enginee	onics: Compulsory Development and Proceed al Mechanical Engine rus Aircraft Systems Eri g, Focus Materials in Focus Product Develor Focus Product Develor Focus Theoretical M rus Biomechanics: Con- rus Energy Systems: Co- rus Energy Systems Engineering Co- in Engineering Science nics: Compulsory Development and Prod al Mechanical Engine us Aircraft Systems En- g, Focus Materials in us Mechatronics: Corrus Focus Product Develo	duction: Compulsory pering: Compulsory ngineering: Compulsory ngineering: Compulsory opment and Product Mechanical Engineer mpulsory Compulsory ces: Compulsory duction: Compulsory rering: Compulsory ngineering: Compulsory ngineering: Compulsory ngineering: Scient npulsory opment and Product



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	a Dubbal Teacharburk für des Maashinaabau Ousta 17 11 Faldhuraa 17/11-a V. Sadaraa Vadar alduslla Auftara
	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

ourse 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



Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	2 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	
	Lecture
	Fundamentals of the following machine elements:
	Linear rolling bearings
	 Axes & shafts
	• Seals
	Clutches & brakes
	Belt & chain drives
	Gear drives
	• Epicyclic gears
	Grank 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	 Dubbal Taasbaabuab für dan Maasbiaasbau Orata K. H. Faldhussen, J. Uken V. Ondersen Veders, although Außen.
	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 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 M0708: Electrical E	Engineering III: Circuit Theory and Transients			
Courses				
Title		Тур	Hrs/wk	CP
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 learn	ning results		
Professional Competence		-		
Knowledge	Students are able to explain the basic methods for calculating electri	ical circuits. They know the Fouri	er series analvsis of li	near networks driven t
	periodic signals. They know the methods for transient analysis of line	•		
	frequency behaviour and the synthesis of passive two-terminal-circuits.		, ,,	
Skills	The students are able to calculate currents and voltages in linear netw	orks by means of basic methods.	also when driven by p	eriodic signals. They a
	able to calculate transients in electrical circuits in time and frequency do	•		• •
	analyse and to synthesize the frequency behaviour of passive two-term			
Personal Competence				
Social Competence	Students work on exercise tasks in small guided groups. They are enco	uraged to present and discuss the	ir results within the aro	an.
p	······································			- F
Autonomy	The students are able to find out the required methods for solving the	niven practice problems. Possibilit	ies are given to test the	eir knowledae durina th
	lectures continuously by means of short-time tests. This allows them t		-	
	knowledge to other courses like Electrical Engineering I and Mathemati			,
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 Electri	cal Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Mecha	anical Engineering, Focus Mechati	ronics: Compulsory	
	General Engineering Science (German program, 7 semester): Specialis	sation Mechanical Engineering, Fo	ocus Mechatronics: Cor	npulsory
	General Engineering Science (German program, 7 semester): Specialis	sation Electrical Engineering: Com	pulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Electric	cal Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Mecha	nical Engineering, Focus Mechatr	onics: Compulsory	
	General Engineering Science (English program, 7 semester): Specialis	ation Mechanical Engineering, Fo	cus Mechatronics: Con	npulsory
	General Engineering Science (English program, 7 semester): Specialis	ation Electrical Engineering: Com	pulsory	
	Computational Science and Engineering: Specialisation Engineering S	ciences: Elective Compulsory		
	Mechatronics: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Elective C			
	Technomathematics: Specialisation III. Engineering Science: Elective C	ompulsory		

Module Manual B. Sc. "General Engineering Science (German program)"



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	ourse L0567: Circuit Theory	
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	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	



Courses				
Title		Тур	Hrs/wk	CP
Simulation and Design of Mechatronic Sys	tems (L1822)	Lecture	2	2
Simulation and Design of Mechatronic Sys		Laboratory	1	2
Simulation and Design of Mechatronic Sys	tems (L1823)	Recitation Section (large)	1	2
Module Responsible	Prof. Uwe Weltin			
Admission Requirements	None			
Recommended Previous	Fundatmentals of mechanics, control theory and elect	rical engineering		
Knowledge				
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	Students are able to describe methods and calculatio	ns for design, modeling, simulation and optimization	on of mechatronic system	ms.
Skills	Students are able to apply modern algorithms for	modeling of mechatronic systems. They can ide	entify, simulate and de	sign simple systems ar
	implement those in laboratory conditions.			
Personal Competence				
Social Competence	Students are able to work goal-oriented in small mixe	d groups and present results to target groups.		
Autonomy	Students are able to recognize and improve knowledge	ge deficits independently.		
	With instructor assistance, students are able to evalua	te their own knowledge level and define a further	course of study.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 5		,	
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Spe	acialisation Mechanical Engineering Focus Mech	atronice: Compulsory	
Curricula	General Engineering Science (German program): Spe			Compulson
Curricula	General Engineering Science (German program): Spe			
			-	
	General Engineering Science (German program, 7 se	, ,		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulso			
	General Engineering Science (German program, 7	semester): Specialisation Mechanical Engineer	ng, Focus Theoretical	Mechanical Engineerin
	Elective Compulsory			
	General Engineering Science (English program): Spe	• •		Compulsory
	General Engineering Science (English program): Spe			
	General Engineering Science (English program): Spe	cialisation Mechanical Engineering, Focus Theore	etical Mechanical Engin	eering: Compulsory
	General Engineering Science (English program, 7 se	mester): Specialisation Mechanical Engineering, F	ocus Mechatronics: Co	mpulsory
	General Engineering Science (English program, 7 se	mester): Specialisation Mechanical Engineering, F	ocus Aircraft Systems E	ingineering: Compulsor
	General Engineering Science (English program, 7	semester): Specialisation Mechanical Engineeri	ng, Focus Theoretical	Mechanical Engineerir
	Elective Compulsory			
	Mechanical Engineering: Specialisation Aircraft Syste	ms Engineering: Compulsory		
	Mechanical Engineering: Specialisation Mechatronics	: Compulsory		
	Mechanical Engineering: Specialisation Theoretical N			

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 Desig	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 Desig	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	



Module M0777: Semicondu	uctor Circuit Design			
Courses				
Title		Тур	Hrs/wk	CP
Semiconductor Circuit Design (L0763)		Lecture	3	4
Semiconductor Circuit Design (L0864)	I	Recitation Section (small)	1	2
Module Responsible				
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	of different MOS devices in electronic circuits.		
	Students know the fundamental digital logic c	ircuits and can discuss their advantages and disadva	ntages.	
	 Students have solid knowledge about memory 	y circuits and can explain their functionality and spec	ifications.	
	Students are able to explain how analog circu	its functions and where they are applied.		
	Students know the appropriate fields for the u	se of bipolar transistors.		
Skills				
		ifferent MOS devices and can define the parameters of	of electronic circuits.	
		rcuits and can design different types of logic circuits.		
	 Students can use MOS devices, operational a 	implifiers and bipolar transistors for specific application	ons.	
Personal Competence				
Social Competence				
	Students are able work efficiently in heterogen			
	 Students working together in small groups can 	n solve problems and answer professional questions	S.	
Autonomy	 Students are able to assess their level of know 	vlodao		
		wiedge.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture	56		
Credit points	6			
Examination				
Examination duration and scale	120 min			
Assignment for the Following		ecialisation Electrical Engineering: Compulsory		
Curricula			onics: Compulsory	
ou noua	General Engineering Science (German program, 7 se			
	General Engineering Science (German program, 7 se			pulsory
	Electrical Engineering: Core qualification: Compulso			
	General Engineering Science (English program): Spe			
	General Engineering Science (English program): Spe		nics: Compulsory	
	General Engineering Science (English program). Sp			
				auleon
	General Engineering Science (English program, 7 se		us mecharonics: Com	JuisUry
	Mechanical Engineering: Specialisation Mechatronic	s. Compulsory		
	Mechatronics: Core qualification: Compulsory			
	Technomathematics: Core qualification: Elective Con			
	Technomathematics: Specialisation III. Engineering S	science. Elective Compulsory		



Course L0763: Semiconductor Circ	uit Design
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	 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



9783642208867 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4	Course L0864: Semiconductor Circ	uit Design
CP 2 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 Scaling-down of CMOS circuits and further performance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exempting vircuits Electrical behavoir of BICMOS circuits Literature R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auffage, 2011, ISBN: 0471700555 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. Tieze und Ch. Schenk, E. Gamm, Halbleiterschaltungstechnik, Springer Verlag Berlin Heidelberg, 2011, ISBN: 9783642208874 ISBN 9783642208877 URL: http://site.ebrary.com/lib/altities/docDetail.action?docID=10499499 URL: http://site.ebrary.com/lib/altities/docDetail.action?docID=10499499 URL: http://dx.dol.org/10.1007/978-3-642-20887.4	Тур	Recitation Section (small)
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 • 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 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: 3488578944 U. 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 URL: http://site.ebrary.com/lib/allitites/docDetail.action?docID=10499499	Hrs/wk	1
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 R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S HG. Wagemann und T. Schönauer, Silizium-Planatechnologie, 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, Halbieiterschaltungstechnik, Springer Verlag, 14. Auflage, 2012, ISBN 3540428496 H. Göbel, Einführung in die Halbieiter-Schaltungstechnik, Springer Verlag, 14. Auflage, 2012, ISBN 3540428496 H. Göbel, Einführung in die Halbieiter-Schaltungstechnik, Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208877 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL:	CP	2
Language DE Cycle SoSe Content 	Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
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 Realization 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 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, Systeminitegration, 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, Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208874 ISBN 9783642208867 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499	Lecturer	NN
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 3519004674 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944 U. Tietze und Ch. Schenk, E. Gamm, Halbleiter-Schaltungstechnik, Berlin, Heidelberg Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208874 ISBN 9783642208867 URL: http://site.ebrary.com/lib/alltities/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4	Language	DE
 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 K. 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, Berlin, Heidelberg Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208874 ISBN 9783642208867 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 	Cycle	SoSe
URL: http://www.ciando.com/img/bo	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 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://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://ebooks.ciando.com/book/index.cfm/bok_id/319955

Module Manual B. Sc. "General Engineering Science (German program)"



Module M0854: Mathematic	:s IV			
Courses				
Title		Tun	Hrs/wk	CP
	15 1 1 1 1 1 1 1 1 1 1	Тур		CP .
Differential Equations 2 (Partial Differentia		Lecture	2	1
Differential Equations 2 (Partial Differentia		Recitation Section (small)	1	1
Differential Equations 2 (Partial Differentia	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				
-				
Educational Objectives	After taking part successfully, students have reached the for	ollowing learning results		
Professional Competence				
Knowledge				
	Students can name the basic concepts in Mathema	atics IV. They are able to explain them using app	ropriate examples.	
	 Students can discuss logical connections between 	these concepts. They are capable of illustrating	these connections w	ith the help of example
	They know proof strategies and can reproduce the	m.		
Skills	Students can model problems in Mathematics IV w	with the help of the concepts studied in this cours	e Moreover they are	canable of solving th
	'		e. woreover, trey are	capable of solving ti
	by applying established methods.			
	 Students are able to discover and verify further log 	ical connections between the concepts studied in	n the course.	
	For a given problem, the students can develop and	d execute a suitable approach, and are able to cr	itically evaluate the re	sults.
Personal Competence				
Social Competence				
	Students are able to work together in teams. They			
	 In doing so, they can communicate new concepts 	according to the needs of their cooperating par	tners. Moreover, they	can design example
	check and deepen the understanding of their peer	S.		
Autonomy	Students are capable of checking their understant	ding of complex concepts on their own. They co	an specify open ques	tions precisely and kr
		ung of complex concepts on their own. They ca	an specify open ques	and 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-orier	ited 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 Equation	ons 2)		
Assignment for the Following				
Curricula	General Engineering Science (German program): Special	lisation Mechanical Engineering, Focus Mechatro	onics: Compulsory	
	General Engineering Science (German program): Special	lisation Mechanical Engineering, Focus Theoretic	cal Mechanical Engin	eering: Compulsory
	General Engineering Science (German program): Special	lisation Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 semes		oulsorv	
				muleon
	General Engineering Science (German program, 7 semes	, ,		
	General Engineering Science (German program, 7 sen	nester): Specialisation Mechanical Engineering	, ⊢ocus Theoretical I	viechanical Engineer
	Compulsory			
	General Engineering Science (German program, 7 semes	ster): Specialisation Naval Architecture: Compulse	ory	
	Computer Science: Specialisation Computational Mathem	natics: Elective Compulsory		
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Speciali			
	General Engineering Science (English program): Speciali	sation Naval Architecture: Compulsory		
	General Engineering Science (English program): Speciali	sation Mechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (English program): Speciali	sation Mechanical Engineering. Focus Theoretic	al Mechanical Engine	ering: Compulsorv
	General Engineering Science (English program, 7 semest		-	3
	General Engineering Science (English program, 7 semest	, ,		
	General Engineering Science (English program, 7 sem	nester): Specialisation Mechanical Engineering	Focus Theoretical	Mechanical Engineer
	Compulsory			
	General Engineering Science (English program, 7 semest	ter): Specialisation Naval Architecture: Computer	rv	
	Computational Science and Engineering: Specialisation E	• • • • • •		
	Computational Science and Engineering: Specialisation C	Computer Science: Elective Compulsory		
	Marken and Electron data Oracia Paristan The second statement	anical Engineering: Compulsory		
	Mechanical Engineering: Specialisation Theoretical Mech	anical Engineering. Compusory		
	Mechanical Engineering: Specialisation Mechatronics: Co			
	Mechanical Engineering: Specialisation Mechatronics: Co Mechatronics: Core qualification: Compulsory			
	Mechanical Engineering: Specialisation Mechatronics: Co	ompulsory		



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



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.

Module M0597: Advanced Mechanical Engineering Design Courses Title Typ Hrs/wk CP Advanced Mechanical Engineering Design II (L0264) Lecture 2 Advanced Mechanical Engineering Design II (L0265) Recitation Section (large) 2 1 Advanced Mechanical Engineering Design I (L0262) Lecture 2 2 Advanced Mechanical Engineering Design I (L0263) Recitation Section (large) 2 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 After passing the module, students are able to: Knowledge • explain complex working principles and functions of machine elements and of basic elements of fluidics, explain requirements, selection criteria, application scenarios and practical examples of complex machine elements. indicate the background of dimensioning calculations. Skills After passing the module, students are able to 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 technical drawings and schematic sketches, · evaluate complex designs, technically. Personal Competence Social Competenc 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 Independent Study Time 68, Study Time in Lecture 112 Workload in Hours Credit points 6 Examination Written exam Examination duration and scale 120 Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Curricula 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 Theoretical Mechanical 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 Sciences 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 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 Sciences 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

Module Manual B. Sc. "General Engineering Science (German program)"



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

	a Frankesselen Besten II
Course L0264: Advanced Mechanic	
Тур	
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 & shaft
	Clutches & brakes
	Belt & chain drives
	 Gear drives
	• Epicyclic gears
	Crank gears
	 Sliding bearings
	Calculations of hydrostatic systems (fluidics)
Literature	a Dubbal Taashaabuub Kadaa Maashiaashau Quda K II Taldhuua (1995) Qofoo (1995) a shu iyo A Roo
	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



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
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:
	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.
	 Konstruktionsterile, Fain, G., Beiz, W., Spinger-Verlag, aktuelle Adlage. Maschinenelemente 1-2; Schlecht, B., Pearson 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



Module M0596: Advanced	Mechanical Design Project			
Courses				
Title		Тур	Hrs/wk	CP
Advanced Mechanical Design Project (L0	266)	Practical Course	4	6
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	Mechanical Engineering: Design			
Knowledge	Advanced Mechanical Engineering Design			
Educational Objectives	After taking part successfully, students have reached the following lear	ning 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 possibil	lities,		
	explain guidelines for designing for function and manufacturing],		
	explain advanced use-oriented knowledge of machine element	ts.		
Skillo	After people the module, students are able to:			
SKIIIS	After passing the module, students are able to:			
	 analyze complex tasks and develop principle solutions using sl 	ketches,		
	 convert principle solutions into a detailed design, 			
	 use methods to design and solve engineering design tasks sys 	tematically and solution-oriente	d,	
	 create a technical documentation including all necessary techn 	ical drawings to understand the	functions of the system,	
	document calculations of selected machine elements clearly an	nd in detail.		
Personal Competence				
Social Competence	After passing the module, students are able to:			
	 present and discuss solutions and technical drawings within group 	oups,		
	 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 necessa	ry knowledge and selecting	g appropriate methods,
	 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 Mech	anical Engineering, Focus Aircr	raft Systems Engineering: C	Compulsory
Curricula	General Engineering Science (German program): Specialisation Mech	anical Engineering, Focus Prod	luct Development and Proc	duction: Compulsory
	General Engineering Science (German program): Specialisation Mech	anical Engineering, Focus Theo	pretical Mechanical Engine	ering: Compulsory
	General Engineering Science (German program, 7 semester): Speciali	isation Mechanical Engineering	, Focus Aircraft Systems Er	ngineering: Compulsor
	General Engineering Science (German program, 7 semester): Speci	alisation Mechanical Engineer	ing, Focus Product Develo	opment and Production
	Compulsory			
	General Engineering Science (German program, 7 semester): Spec	cialisation Mechanical Enginee	ering, Focus Theoretical N	lechanical Engineerin
	Compulsory			
	General Engineering Science (English program): Specialisation Mecha			
	General Engineering Science (English program): Specialisation Mecha			
	General Engineering Science (English program): Specialisation Mecha	0 0,	0	0 1 3
	General Engineering Science (English program, 7 semester): Specialis		-	
	General Engineering Science (English program, 7 semester): Speci-	alisation Mechanical Engineeri	ing, Focus Product Develo	opment and Production
	Compulsory			–
	General Engineering Science (English program, 7 semester): Spec	cialisation Mechanical Enginee	ring, Focus Theoretical N	lechanical Engineering
	Compulsory			
	Mechanical Engineering: Core qualification: Compulsory			



Course L0266: Advanced Mechanic	al Desian Project
	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	CP
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 e	electrical engineering		
Educational Objectives	After taking part successfully, students have reached t	a following loarning results		
Educational Objectives	After taking part successfully, students have reached the	le lonowing learning results		
Professional Competence Knowledge	Students are able to			
Kilowledge				
	explain the basics of chip formation and mecha	anisms and models of machining.		
	 explain methods and parameters for design an 	d analysis of metal forming, machining processes	and tools.	
	 explain technical concepts of machine tool buil 	ding and give an overview on trends in the mach	ine tool industry.	
	 explain types, constructions and functions of C 	NC-machines and give an overview on multi-mac	hine systems.	
	 explain equipment components. 			
Skills	Students are able to			
	 select tool geometry, cutting materials, process 	parameters and appropriate measuring techniqu	e in accordance with the	e requirements.
	 estimate occurring forces and temperatures du 			
	•	and create NC programs for turning and milling.		
	 assess the quality of a machine tools and to de 			
Personal Competence				
Social Competence	Students are able to			
	develop solutions in a production environment	with qualified personnel at technical level and re	present decisions.	
Autonomy	Students are able to			
	 interpret independently cutting processes. 			
	 create independently NC programs. 			
	select independently machine tools by reference	ce to appropriate requirements.		
	assess own strengths and weaknesses in gene	eral.		
	assess their learning progress and define gaps	s to be improved.		
	 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			
Assignment for the Following	General Engineering Science (German program): Spe	cialisation Mechanical Engineering, Focus Produ	ict Development and Pro	oduction: Compulsory
Curricula	General Engineering Science (German program, 7 s	emester): Specialisation Mechanical Engineering	ng, Focus Product Deve	elopment and Productio
	Compulsory			
	General Engineering Science (English program): Spec	cialisation Mechanical Engineering, Focus Produ	ct Development and Pro	duction: Compulsory
	General Engineering Science (English program, 7 s	emester): Specialisation Mechanical Engineerir	g, Focus Product Deve	lopment and Productio
	Compulsory			
	Mechanical Engineering: Specialisation Product Deve	lopment and Production: Compulsory		
	Product Development, Materials and Production: Tech			



Course L0689: Fundamentals of Ma	abies Tools
Тур	Lecture
Hrs/wk	3
CP Workload in Hours	3 Independent Study Time 49, Study Time in Lecture 42
Lecturer	Independent Study Time 48, Study Time in Lecture 42
Language	Prof. Thorsten Schüppstuhl 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 <i>Massivumformung</i> , 4. Auflage, VDI-Verlag (1996) König, W., Klocke, F.; Fertigungsverfahren Bd. 5 <i>Blechbearbeitung</i> , 3. Auflage, VDI-Verlag (1995) Klocke, F., König, W.; Fertigungsverfahren <i>Schleifen, Honen, Läppen</i> , 4. Auflage, Springer Verlag (2005) König, W., Klocke, F.: Fertigungsverfahren <i>Drehen, Fräsen, Bohren</i> , 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



Module M1009: Material Sci	ience Laboratory			
Module M1003. Material Sci				
Courses				
Title		Тур	Hrs/wk	CP
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 follow	ring learning results		
Professional Competence				
Knowledge	Students are able to give a summary of the technical details of	experiments in the area of materials scie	ences and illustrate respe	ctive relationships. They
	are capable of describing and communicating relevant prob	lems and questions using appropriate t	echnical language. They	can explain the typical
	process of solving practical problems and present related resu	lts.		
Skills	The students can transfer their fundamental knowledge on m	aterial sciences to the process of solving	practical problems. The	v identify and overcome
	typical problems during the realization of experiments in the co		, p	,,
Personal Competence				
Social Competence				
	and explain their results alone or in groups in front of a qualifie	d audience.		
Autonomy	Students are capable of solving problems in the context of m	aterials sciences using provided literatu	re. They are able to fill g	aps in as well as extent
	their knowledge using the literature and other sources provide	d by the supervisor.		
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	on Mechanical Engineering, Focus Mater	ials in Engineering Scien	ces: Compulsory
Curricula	General Engineering Science (German program): Specialisation	on Mechanical Engineering, Focus Produ	ct Development and Proc	luction: Compulsory
	General Engineering Science (German program, 7 semest	er): Specialisation Mechanical Enginee	ring, Focus Materials in	Engineering Sciences:
	Compulsory			
	General Engineering Science (English program): Specialisation	n Mechanical Engineering, Focus Materi	als in Engineering Scienc	es: Compulsory
	General Engineering Science (English program): Specialisation	n Mechanical Engineering, Focus Produ	ct Development and Prod	uction: Compulsory
	General Engineering Science (English program, 7 semeste	er): Specialisation Mechanical Enginee	ring, Focus Materials in	Engineering Sciences:
	Compulsory			
	Mechanical Engineering: Specialisation Product Development	1 3		
	Mechanical Engineering: Specialisation Materials in Engineer			
	Product Development, Materials and Production: Technical Co	mplementary Course Core Studies: Elec	ive Compulsory	

Course L1088: Companion Lecture for Materials Science 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 Lab	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	



Cauraaa				
Courses		T	Here fords	05
Title		Typ	Hrs/wk 2	CP 2
CAE-Team Project (L0271) Development of Lightweight Design Products (L0270)		Problem-based Learning Lecture	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 foll	lowing learning results		
Professional Competence				
Knowledge	After completing the module, students are capable of:			
	 explaining the functional principle of 3D-CAD-Syster 	ms, PDM- and FEM-Systems		
	describing the interaction of the different CAE-System			
Skills				
SKIIIS				
	After completing the module, students are able to:			
	 evaluate different CAD- and PDM-Systems with regative design an exemplary product using CAD-,PDM- and 		fication schemes and	product structuring
Personal Competence				
Social Competence	After completing the module, students are able to:			
	 To develop a project plan and allocate work appropri 	riate work packages in the framework of group	discussions	
	 Present project results as a team for instance in a project results. 		010000010110	
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	6			
Examination	Written exam			
Examination duration and scale	90			
Assignment for the Following	General Engineering Science (German program): Specialis	ation Mechanical Engineering, Focus Aircraft S	Systems Engineering:	Compulsory
Curricula	General Engineering Science (German program): Specialis	ation Mechanical Engineering, Focus Product	Development and Pro	duction: Compulsory
	General Engineering Science (German program, 7 semeste	er): Specialisation Mechanical Engineering, Foo	cus Aircraft Systems E	ngineering: Compulso
	General Engineering Science (German program, 7 semes	ster): Specialisation Mechanical Engineering,	Focus Product Deve	lopment and Production
	Compulsory			~ .
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester	• •		
	General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 semester		-	
	Compulsory	, , , , , , , , , , , , , , , , , , ,		
	Mechanical Engineering: Specialisation Product Developme	ent and Production: Compulsory		
	Mechanical Engineering: Specialisation Aircraft Systems Er	ngineering: Compulsory		
	Product Development, Materials and Production: Technical	Complementary Course Core Studios: Elective	Compulson	



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	tweight Design Products
Тур	Lecture
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	 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	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 	



Focus Theoretical Mechanical Engineering

Module M0597: Advanced	Mechanical Engineering Design			
Courses				
Fitle Advanced Mechanical Engineering Desigr	n II (1.0264)	Typ Lecture	Hrs/wk CP 2 2	
Advanced Mechanical Engineering Design		Recitation Section (large)	2 1	
Advanced Mechanical Engineering Design		Lecture	2 2	
Advanced Mechanical Engineering Design	n I (L0263)	Recitation Section (large)	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 for	ollowing learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	explain complex working principles and functions of	of machine elements and of basic elements of flui	idics.	
	 explain requirements, selection criteria, application 			
	 indicate the background of dimensioning calculation 		,	
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of covered r	machine elements,		
	 transfer knowledge learned in the module to new r 			
	recognize the content of technical drawings and so	chematic sketches,		
	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 a	cauired knowledge in exercises.		
	 Students are able to acquire additional knowled 		ent e.a. by using the video recordi	nas of
	lectures.			9
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
• ••• • •	6			
Credit points				
Examination	Written exam			
Examination Examination duration and scale	Written exam 120			
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special			
Examination Examination	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program): Special	isation Mechanical Engineering, Focus Aircraft S	ystems Engineering: Compulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program): Special General Engineering Science (German program): Special	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials	stems Engineering: Compulsory in Engineering Sciences: Compuls	ory
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program): Special General Engineering Science (German program): Special General Engineering Science (German program): Special	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro	ystems Engineering: Compulsory in Engineering Sciences: Compuls nics: Compulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program): Special	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D	ystems Engineering: Compulsory in Engineering Sciences: Compuls nics: Compulsory Development and Production: Comp	ulsory
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program): Special	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product E isation Mechanical Engineering, Focus Theoretic	ystems Engineering: Compulsory in Engineering Sciences: Compuls inics: Compulsory Development and Production: Comp al Mechanical Engineering: Compu	ulsory Isory
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program): Special	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product E isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, Foc	stems Engineering: Compulsory in Engineering Sciences: Compuls inics: Compulsory Development and Production: Comp al Mechanical Engineering: Compu- us Aircraft Systems Engineering: Co	ulsory Isory ompuls
Examination Examination duration and scale Assignment for the Following	Written exam 120 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 semes	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product E isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, Foc	stems Engineering: Compulsory in Engineering Sciences: Compuls inics: Compulsory Development and Production: Comp al Mechanical Engineering: Compu- us Aircraft Systems Engineering: Co	ulsory Isory ompuls
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (German program, 7 ser Compulsory	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, mester): Specialisation Mechanical Engineering	stems Engineering: Compulsory in Engineering Sciences: Compuls inics: Compulsory Development and Production: Comp al Mechanical Engineering: Compu us Aircraft Systems Engineering: Co g, Focus Materials in Engineering	ulsory Isory ompuls
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (German program, 7 semes Special Science (German program, 7 semes)	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, Foc	sstems Engineering: Compulsory in Engineering Sciences: Compuls inics: Compulsory Development and Production: Comp al Mechanical Engineering: Compu us Aircraft Systems Engineering: Co g, Focus Materials in Engineering us Mechatronics: Compulsory	ulsory Isory ompuls Sciend
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (German program), 7 semes General E	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, Foc	sstems Engineering: Compulsory in Engineering Sciences: Compuls inics: Compulsory Development and Production: Comp al Mechanical Engineering: Compu us Aircraft Systems Engineering: Co g, Focus Materials in Engineering us Mechatronics: Compulsory	ulsory Isory ompuls Sciend
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (German program) (Semes)	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, Foc	sstems Engineering: Compulsory in Engineering Sciences: Compuls inics: Compulsory Development and Production: Comp ial Mechanical Engineering: Compu us Aircraft Systems Engineering: Co g, Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F	ulsory Isory ompuls Scient
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (German program), 7 semes General E	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, Foc	sstems Engineering: Compulsory in Engineering Sciences: Compuls inics: Compulsory Development and Production: Comp ial Mechanical Engineering: Compu us Aircraft Systems Engineering: Co g, Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F	ulsory Isory ompuls Scient
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (German program) (General Engineering Science (German) (General Science (German) (General Science (German) (General Science (German) (General Sc	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, Foc	stems Engineering: Compulsory in Engineering Sciences: Compulsory on Engineering Sciences: Compulsory Development and Production: Compu- al Mechanical Engineering: Compu- us Aircraft Systems Engineering of Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F Focus Theoretical Mechanical Er	ulsory Isory ompuls Scient
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Compulsory	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, foc	stems Engineering: Compulsory in Engineering Sciences: Compulsory on Engineering Sciences: Compulsory Development and Production: Compu- al Mechanical Engineering: Compu- us Aircraft Systems Engineering of Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory	ulsory Isory ompuls Scient
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (German program, 7 semes Compulsory General Engineering Science (German program, 7 semes Compulsory General Engineering Science (German program, 7 semes Compulsory General Engineering Science (German program, 7 semes Compulsory	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, foc ter): Specialisation Mechanical Engineering, foc ter): Specialisation Mechanical Engineering, foc	stems Engineering: Compulsory in Engineering Sciences: Compulsory on Engineering Sciences: Compulsory Development and Production: Compu- cal Mechanical Engineering: Compu- us Aircraft Systems Engineering of Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory us Energy Systems: Compulsory	ulsory Isory ompuls Scient
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (German program)	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Methatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, foc	stems Engineering: Compulsory in Engineering Sciences: Compulsory on Engineering Sciences: Compulsory cal Mechanical Engineering: Compu- us Aircraft Systems Engineering: Co g, Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory us Energy Systems: Compulsory ystems: Compulsory	ulsory Isory ompuls Scient
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (English program): Speciali	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, Foc sation Mechanical Engineering, Focus Energy Sy sation Mechanical Engineering, Focus Aircraft Sy	stems Engineering: Compulsory in Engineering Sciences: Compulsory on Engineering Sciences: Compulsory cal Mechanical Engineering: Compu- us Aircraft Systems Engineering: Co g, Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory us Energy Systems: Compulsory ystems: Compulsory restems Engineering: Compulsory	ulsory Isory ompulso Science Product
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (German program), 7 semes General Engineering Science (English program): Speciali General Engineering Science (English program): Speciali	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, Foc nester): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, Foc sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Aircraft Sy sation Mechanical Engineering, Focus Materials	stems Engineering: Compulsory in Engineering Sciences: Compulsory cal Mechanical Engineering: Compu- sal Mechanical Engineering: Compu- us Aircraft Systems Engineering: Co g, Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory us Energy Systems: Compulsory ystems: Compulsory restems Engineering: Compulsory in Engineering Sciences: Compulsor	ulsory Isory ompulso Science Product
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (English program): Speciali General Engineering Science (English program): Speciali General Engineering Science (English program): Speciali	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, Foc nester): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, Foc sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Materials sation Mechanical Engineering, Focus Materials sation Mechanical Engineering, Focus Methanical Sation Mechanical Engineering, Focus Methanical Sation Mechanical Engineering, Focus Methanical Sation Mechanical Engineering, Focus Materials	stems Engineering: Compulsory in Engineering Sciences: Compulsory cal Mechanical Engineering: Compu- sal Mechanical Engineering: Compu- us Aircraft Systems Engineering: Co g, Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory us Energy Systems: Compulsory ystems: Compulsory restems Engineering: Compulsory in Engineering Sciences: Compulsor incs: Compulsory	ulsory Isory ompuls Scient Product ugineer
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (English program): Speciali General Engineering Science (English program): Speciali	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, Foc sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Aircraft Sy sation Mechanical Engineering, Focus Materials sation Mechanical Engineering, Focus Mechatro sation Mechanical Engineering, Focus Mechatro sation Mechanical Engineering, Focus Product D	stems Engineering: Compulsory in Engineering Sciences: Compulsory cal Mechanical Engineering: Compu- sal Mechanical Engineering: Compu- sal Mechanical Engineering: Compu- us Aircraft Systems Engineering of product Development and F Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory us Energy Systems: Compulsory ystems Engineering: Compulsory in Engineering Sciences: Compulsory in Engineering Sciences: Compulsory in Engineering Sciences: Compulsory is evelopment and Production: Comp	ulsory Isory ompuls Scient Product Igineer
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (English program): Speciali General Engineering Science (English program): Speciali	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus ation Mechanical Engineering, Focus sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Aircraft Sy sation Mechanical Engineering, Focus Materials sation Mechanical Engineering, Focus Methanical sation Mechanical Engineering, Focus Methanical sation Mechanical Engineering, Focus Mechatron sation Mechanical Engineering, Focus Mechatron	stems Engineering: Compulsory in Engineering Sciences: Compulsory cal Mechanical Engineering: Compu- sal Mechanical Engineering: Compu- sal Mechanical Engineering: Compu- us Aircraft Systems Engineering: Co g, Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory us Energy Systems: Compulsory ystems Engineering: Compulsory in Engineering Sciences: Compulsory in Engineering Sciences: Compulsory is evelopment and Production: Comp al Mechanical Engineering: Compus	ulsory Isory Ompuls Scient Product Igineer ory ulsory sory
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (English program): Speciali General Engineering Science (English program): Speciali	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, Foc sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Materials sation Mechanical Engineering, Focus Methatron sation Mechanical Engineering, Focus Product D sation Mechanical Engineering, Focus Theoretic er): Specialisation Mechanical Engineering, Focus Theoretic er): Specialisation Mechanical Engineering, Focus Theoretic	stems Engineering: Compulsory in Engineering Sciences: Compulson Development and Production: Comp al Mechanical Engineering: Compu us Aircraft Systems Engineering Cous Materials in Engineering of the coust of the compulsory Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory us Energy Systems: Compulsory vestems Engineering: Compulsory in Engineering Sciences: Compulsory in Engineering Sciences: Compulsory is evelopment and Production: Comp al Mechanical Engineering: Compu- us Aircraft Systems Engineering: Compu- compulsory	ulsory Isory Science Product Igineer pry ulsory sory mpulso
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (German program), 7 semes General Engineering Science (English program): Speciali General Engineering Sc	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, Foc sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Materials sation Mechanical Engineering, Focus Methatron sation Mechanical Engineering, Focus Product D sation Mechanical Engineering, Focus Theoretic er): Specialisation Mechanical Engineering, Focus Theoretic er): Specialisation Mechanical Engineering, Focus Theoretic	stems Engineering: Compulsory in Engineering Sciences: Compulson Development and Production: Comp al Mechanical Engineering: Compu us Aircraft Systems Engineering Cous Materials in Engineering of the coust of the compulsory Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory us Energy Systems: Compulsory vestems Engineering: Compulsory in Engineering Sciences: Compulsory in Engineering Sciences: Compulsory is evelopment and Production: Comp al Mechanical Engineering: Compu- us Aircraft Systems Engineering: Compu- compulsory	ulsory Isory Science Product Igineer pry ulsory sory mpulso
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (English program): Speciali General Engineering Science (English program, 7 semest General Engineering Science (English program): Speciali	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, sation Mechanical Engineering, Focus ter): Specialisation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Aircraft Sy sation Mechanical Engineering, Focus Materials sation Mechanical Engineering, Focus Mechatron sation Mechanical Engineering, Focus Product D sation Mechanical Engineering, Focus Theoretica ter): Specialisation Mechanical Engineering, Focus sation Mechanical Engineering, Focus Theoretica ter): Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering, Focus ter): Specialisation Mechanical Engineering, Focus	systems Engineering: Compulsory in Engineering Sciences: Compulsory covelopment and Production: Comp al Mechanical Engineering: Compulsory us Aircraft Systems Engineering: Co a, Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory us Energy Systems: Compulsory ystems Engineering: Compulsory in Engineering Sciences: Compulsor in Engineering Sciences: Compulsory in Engineering Sciences: Compulsory al Mechanical Engineering: Compu as Aircraft Systems Engineering: Co a, Focus Materials in Engineering	ulsory mpuls Scien Product ggineer pry ulsory sory mpulso
Examination Examination duration and scale Assignment for the Following	Written exam 120 General Engineering Science (German program): Special General Engineering Science (German program, 7 semes General Engineering Science (English program): Speciali General Engineering Science (English program, 7 semest General Engineering Science (English program): Speciali	isation Mechanical Engineering, Focus Aircraft S isation Mechanical Engineering, Focus Materials isation Mechanical Engineering, Focus Mechatro isation Mechanical Engineering, Focus Product D isation Mechanical Engineering, Focus Theoretic ter): Specialisation Mechanical Engineering, ter): Specialisation Mechanical Engineering, Focus ester): Specialisation Mechanical Engineering, Focus estion Mechanical Engineering, Focus sation Mechanical Engineering, Focus estion Mechanical Engineering, Focus Energy Sy sation Mechanical Engineering, Focus Materials sation Mechanical Engineering, Focus Materials sation Mechanical Engineering, Focus Mechatron sation Mechanical Engineering, Focus Product D sation Mechanical Engineering, Focus Theoretica ter): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Focus etron Mechanical Engineering, Focus Theoretica ter): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Focus	systems Engineering: Compulsory in Engineering Sciences: Compulsory cevelopment and Production: Comp al Mechanical Engineering: Compulsory us Aircraft Systems Engineering: Co g, Focus Materials in Engineering us Mechatronics: Compulsory Focus Product Development and F Focus Theoretical Mechanical Er us Biomechanics: Compulsory us Energy Systems: Compulsory ystems Engineering: Compulsory in Engineering Sciences: Compulsor in Engineering Sciences: Compulsory in Engineering Sciences: Compulsory al Mechanical Engineering: Compulsory al Mechanical Engineering: Compulsory to start Systems Engineering: Compulsory is Focus Materials in Engineering compulsory start Systems Engineering: Compulsory is Mechatronics: Compulsory	ulsory mpuls Scien Product ngineer pry ulsory sory mpulso Scien



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.
	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
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	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:
	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.
	 Emunrung in die Div-Normen; klein, w., reubner-verlag. Konstruktionslehre, Pahl, G.; Beitz, W., 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 Mechanic	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	



le dule MOCO / Lle et T				
lodule M0684: Heat Trans	ier			
ourses				
tle		Тур	Hrs/wk	CP
eat Transfer (L0458)		Lecture	3	4
eat 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 follo	wing 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 approach.		
	—			
Autonomy	The students are able to develop a complex problem self-cor	isistent and analyse the results in a critical w	ay. A qualified exchan	ge with other students
	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): Specialisat	ion Mechanical Engineering, Focus Biomech	nanics: Compulsory	
Curricula	General Engineering Science (German program): Specialisat	ion Mechanical Engineering, Focus Energy	Systems: Compulsory	
	General Engineering Science (German program): Specialisat	tion Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisat	tion Mechanical Engineering, Focus Theoreti	ical Mechanical Engine	ering: Compulsory
	General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering, Fo	cus Energy Systems: C	ompulsory
	General Engineering Science (German program, 7 semest	ter): Specialisation Mechanical Engineering	g, Focus Theoretical N	lechanical Engineer
	Compulsory			
	General Engineering Science (German program, 7 semester)	: Specialisation Biomedical Engineering: Co	mpulsory	
	General Engineering Science (English program): Specialisati	on Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Biomech	anics: Compulsory	
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Energy S	Systems: Compulsory	
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semest	er): Specialisation Mechanical Engineering	, Focus Theoretical M	lechanical Engineer
	Compulsory			
	General Engineering Science (English program, 7 semester):		mpulsory	
	Mechanical Engineering: Specialisation Energy Systems: Con	mpulsory		
	Mechanical Engineering: Specialisation Theoretical Mechani			

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	ourse 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				
Title		Тур	Hrs/wk	CP
Simulation and Design of Mechatronic Systems (L1822)		Lecture	2	2
Simulation and Design of Mechatronic Sys Simulation and Design of Mechatronic Sys		Laboratory Recitation Section (large)	1	2
Module Responsible	Prof. Uwe Weltin	necitation Section (large)	I	2
Admission Requirements	None			
Recommended Previous	Fundatmentals of mechanics, control theory and electrica	Longingering		
Knowledge	Fundamentals of mechanics, control theory and electrica	rengineering		
Educational Objectives	After taking part successfully, students have reached the f	allowing loarning results		
	Alter taking part successiony, students have reached the r	ollowing learning results		
Professional Competence	Students are able to describe methods and coloulations for	ar design modeling simulation and entimization	n of mochotropic quato	
Knowledge	Students are able to describe methods and calculations for	or design, modeling, simulation and optimizatio	in of mechatronic syste	ms.
Skills	Students are able to apply modern algorithms for mod	leling of mechatronic systems. They can ide	ntify, simulate and de	sign simple systems ar
	implement those in laboratory conditions.			
Personal Competence				
Social Competence	Students are able to work goal-oriented in small mixed gr	ounc and procent results to target groups		
Social Competence	Students are able to work goar-oriented in small mixed gr	oups and present results to target groups.		
Autonomy	Autonomy Students are able to recognize and improve knowledge deficits independently.			
	With instructor assistance, students are able to evaluate th	peir own knowledge level and define a further	course of study	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	ten own knowledge level and define a larger	Source of Study.	
Credit points	6			
Examination	vitten exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specia	lisation Mechanical Engineering Focus Mecha	tronice: Compulsory	
Curricula	General Engineering Science (German program): Specia			Compulsory
Guindad	General Engineering Science (German program): Specia			
	General Engineering Science (German program, 7 semes	• •	Į.	
	General Engineering Science (German program, 7 semes	, ,		
	General Engineering Science (German program, 7 ser	, ,	-	
	Elective Compulsory			
	General Engineering Science (English program): Special	isation Mechanical Engineering, Focus Aircraft	Systems Engineering:	Compulsory
	General Engineering Science (English program): Special	isation Mechanical Engineering, Focus Mecha	tronics: Compulsory	
	General Engineering Science (English program): Special	isation Mechanical Engineering, Focus Theore	tical Mechanical Engin	eering: Compulsory
	General Engineering Science (English program, 7 semes	ter): Specialisation Mechanical Engineering, F	ocus Mechatronics: Co	mpulsory
	General Engineering Science (English program, 7 semes	ter): Specialisation Mechanical Engineering, F	ocus Aircraft Systems E	ngineering: Compulsor
	General Engineering Science (English program, 7 sen	nester): Specialisation Mechanical Engineerin	ng, Focus Theoretical	Mechanical Engineerin
	Elective Compulsory			
	Mechanical Engineering: Specialisation Aircraft Systems			
	Mechanical Engineering: Specialisation Mechatronics: Co			
	Mechanical Engineering: Specialisation Theoretical Mech	nanical Engineering: Compulsory		
	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 Desig	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 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 Advanced Mechanical Design Project (LC Module Responsible Admission Requirements Recommended Previous Knowledge Educational Objectives	Prof. Dieter Krause None Mechanical Engineering: Design
Advanced Mechanical Design Project (LC Module Responsible Admission Requirements Recommended Previous Knowledge	D2266) Practical Course 4 6 Prof. Dieter Krause None • Mechanical Engineering: Design
Module Responsible Admission Requirements Recommended Previous Knowledge	Prof. Dieter Krause None Mechanical Engineering: Design
Admission Requirements Recommended Previous Knowledge	None Mechanical Engineering: Design
Recommended Previous Knowledge	Mechanical Engineering: Design
Knowledge	Mechanical Engineering: Design
-	• Mechanical Lingheeting. Design
Educational Objectives	Advanced Mechanical Engineering Design
Educational Objectives	
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.
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
A	
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.
Warkload in Hours	Independent Chudu Time 104, Chudu Time in Lecture 56
Examination duration and scale	
	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Assignment for the Following	
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory
Assignment for the Following	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: Compulsory
Assignment for the Following	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: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product
Assignment for the Following	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: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory
Assignment for the Following	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 Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer
Assignment for the Following	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 Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Compulsory
Assignment for the Following	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: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compuls 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 Theoretical Mechanical Engineer Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Assignment for the Following	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 Aircraft Systems Engineering: Compulso 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 Theoretical Mechanical Engineer 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
Assignment for the Following	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: 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 Theoretical Mechanical Engineer 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 Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory
Assignment for the Following	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: 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 Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer 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 Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: 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 Aircraft Systems Engineering: Compulsory
Assignment for the Following	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: 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 Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer 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 Theoretical Mechanical Engineering: 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 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 Product
Assignment for the Following	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: 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 Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer 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 Theoretical 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 Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory
Assignment for the Following	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: 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 Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer 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 Theoretical Mechanical Engineering: 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 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 Product
Workload in Hours Credit points Examination Examination duration and scale	to independently solve problems. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 180



Course L0266: Advanced Mechanic	al Design Project
	Practical Course
Hrs/wk	
CP	
Workload in Hours	
Lecturer	
Language	
	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, 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. Sowie weitere Bücher zu speziellen Themen

Module Manual B. Sc. "General Engineering Science (German program)"



	es IV			
Courses				
Title		Тур	Hrs/wk	CP
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
				4
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	following learning results		
-		5 5		
Professional Competence				
Knowledge	• Otudente con nome the basis concerts in Method			
	 Students can name the basic concepts in Mathem 			
	 Students can discuss logical connections between 	n these concepts. They are capable of illustrating	these connections wi	th the help of example
	 They know proof strategies and can reproduce the 	em.		
Skills				
	 Students can model problems in Mathematics IV 	with the help of the concepts studied in this course	e. Moreover, they are	capable of solving th
	by applying established methods.			
	 Students are able to discover and verify further log 	gical connections between the concepts studied in	the course	
		- '		
	 For a given problem, the students can develop an 	id execute a suitable approach, and are able to cri	tically evaluate the re	sults.
Personal Competence				
Social Competence				
	 Students are able to work together in teams. They 	are capable to use mathematics as a common lar	iguage.	
	 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	ire .		
	check and deepen are anderstanding of aren pee			
Autonomy				
Autonomy	 Students are capable of checking their understar 	nding of complex concepts on their own. They ca	n specify open quest	ions precisely and kr
	where to get help in solving them.	5 I I I		, ,
	 Students have developed sufficient persistence to 	be able to work for longer periods in a goal-orien	ted manner on hard p	roblems.
WeddeedbyUser				
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Workload in Hours Credit points				
Credit points	6			
Credit points Examination	6 Written exam			
Credit points Examination Examination duration and scale	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equation	,		
Credit points Examination	6 Written exam	,		
Credit points Examination Examination duration and scale	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equation	alisation Electrical Engineering: Compulsory	nics: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro		ering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic		eering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory	al Mechanical Engine	ering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory	al Mechanical Engine	eering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp	al Mechanical Engine	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp Ister): Specialisation Mechanical Engineering, Foc	al Mechanical Engine ulsory us Mechatronics: Cor	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp Ister): Specialisation Mechanical Engineering, Foc	al Mechanical Engine ulsory us Mechatronics: Cor	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp Ister): Specialisation Mechanical Engineering, Foc	al Mechanical Engine ulsory us Mechatronics: Cor	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering,	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathem	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathem	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulso matics: Elective Compulsory	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathen Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory ester): Specialisation Naval Architecture: Compulsory lisation Electrical Engineering: Compulsory	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical N	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathen Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory ester): Specialisation Naval Architecture: Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical M ry	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathen Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory ester): Specialisation Naval Architecture: Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical M ry	npulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathen Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatron	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical M ry nics: Compulsory	npulsory Aechanical Engineer
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati 6eneral Engineering Science (German program): Specia General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mather Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program): Specia General Engineering Science (English program): Specia General Engineering Science (English program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatron lisation Mechanical Engineering, Focus Theoretica	al Mechanical Engine ulsory us Mechatronics: Cor Focus Theoretical M ry hics: Compulsory al Mechanical Engine	npulsory Aechanical Engineer
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathen Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatron lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Comp	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M rry hics: Compulsory al Mechanical Engine Ilsory	npulsory Mechanical Engineer ering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati 6eneral Engineering Science (German program): Specia General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Compulsory General Engineering Science (German program, 7 sem Computer Science: Specialisation Computational Mather Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program): Specia General Engineering Science (English program): Specia General Engineering Science (English program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatron lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Comp	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M rry hics: Compulsory al Mechanical Engine Ilsory	npulsory Mechanical Engineer ering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathen Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specia General Engineering Science (English program): Specia	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor matters: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatron lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering: Compu-	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory us Mechatronics: Corr	npulsory Mechanical Engineer ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathere Electrical Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program), 7 seme Genera	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor matters: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatron lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering: Compu-	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory us Mechatronics: Corr	npulsory Mechanical Engineer ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathere Electrical Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General E	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Focus	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory is Mechatronics: Corr Focus Theoretical M	npulsory Mechanical Engineer ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathere Electrical Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program), 7 seme Genera	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Focus	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory is Mechatronics: Corr Focus Theoretical M	npulsory Mechanical Engineer ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathere Electrical Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General E	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Mechanical Engineering, Socus	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory is Mechatronics: Corr Focus Theoretical M	npulsory Mechanical Engineer ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathere Electrical Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Compulsory	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsor matics: Elective Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Naval Architecture: Compulso mester): Specialisation Naval Architecture: Compulso Engineering Sciences: Elective Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory is Mechatronics: Corr Focus Theoretical M	npulsory Mechanical Engineer ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mather Electrical Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory lisation Electrical Engineering: Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatron lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Naval Architecture: Compulso ester): Specialisation Naval Architecture: Compulso Engineering Sciences: Elective Compulsory Computer Science: Elective Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory is Mechatronics: Corr Focus Theoretical M	npulsory Mechanical Engineer ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mathere Electrical Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Compulsory	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory lisation Electrical Engineering: Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatron lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Naval Architecture: Compulso ester): Specialisation Naval Architecture: Compulso Engineering Sciences: Elective Compulsory Computer Science: Elective Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory is Mechatronics: Corr Focus Theoretical M	npulsory Mechanical Engineer ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mather Electrical Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory lisation Electrical Engineering: Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Naval Architecture: Compulso ester): Specialisation Naval Architecture: Compulsory computer Sciences: Elective Compulsory Computer Science: Elective Compulsory thanical Engineering: Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory is Mechatronics: Corr Focus Theoretical M	npulsory Mechanical Engineer ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mather Electrical Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Mec Mechanical Engineering: Specialisation Mechatronics: C	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory lisation Electrical Engineering: Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Naval Architecture: Compulso ester): Specialisation Naval Architecture: Compulsory computer Sciences: Elective Compulsory Computer Science: Elective Compulsory thanical Engineering: Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory is Mechatronics: Corr Focus Theoretical M	npulsory Mechanical Engineer ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mather Electrical Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Mec Mechanical Engineering: Specialisation Mechatronics: C Mechatronics: Core qualification: Compulsory	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory lisation Electrical Engineering: Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Naval Architecture: Compulso ester): Specialisation Naval Architecture: Compulsory computer Sciences: Elective Compulsory Computer Science: Elective Compulsory thanical Engineering: Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory is Mechatronics: Corr Focus Theoretical M	npulsory Mechanical Engineer ering: Compulsory Ipulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 60 min (Complex Functions) + 60 min (Differential Equati 60 min (Complex Functions) + 60 min (Differential Equati General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program): Specia General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Compulsory General Engineering Science (German program, 7 seme Computer Science: Specialisation Computational Mather Electrical Engineering Science (English program): Specia General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 seme Computational Science and Engineering: Specialisation Computational Science and Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Mec Mechanical Engineering: Specialisation Mechatronics: C	alisation Electrical Engineering: Compulsory alisation Mechanical Engineering, Focus Mechatro alisation Mechanical Engineering, Focus Theoretic alisation Naval Architecture: Compulsory ester): Specialisation Electrical Engineering: Comp ester): Specialisation Mechanical Engineering, Foc mester): Specialisation Mechanical Engineering, ester): Specialisation Naval Architecture: Compulsory lisation Electrical Engineering: Compulsory lisation Electrical Engineering: Compulsory lisation Naval Architecture: Compulsory lisation Naval Architecture: Compulsory lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Mechatror lisation Mechanical Engineering, Focus Theoretica ster): Specialisation Electrical Engineering: Compu- ster): Specialisation Mechanical Engineering, Focus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Mechanical Engineering, Socus mester): Specialisation Naval Architecture: Compulso ester): Specialisation Naval Architecture: Compulsory computer Sciences: Elective Compulsory Computer Science: Elective Compulsory thanical Engineering: Compulsory	al Mechanical Engine ulsory us Mechatronics: Corr Focus Theoretical M ry hics: Compulsory al Mechanical Engine Ilsory is Mechatronics: Corr Focus Theoretical M	npulsory Mechanical Engineer ering: Compulsory Ipulsory



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	

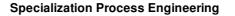
Course L1038: Complex Functions	
Тур	
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	Main features of complex analysis
	 Functions of one complex variable Complex differentiation 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

Ξ



TUHH

Module M0886: Fundament	als of Process Engineering			
Courses				
Title		Тур	Hrs/wk	CP
Introduction into Process Engineering/Biop	rocess Engineering (1.0829)	Lecture	2	1
Fundamentals of material engineering (L08		Lecture	2	2
Module Responsible	Prof. Michael Schlüter			
Admission Requirements	none			
Recommended Previous	none			
Knowledge	lione			
Educational Objectives	After taking part successfully, students have reached th	e following learning results		
	when taking part successionly, stadents have reached in			
Professional Competence	After passing this module the students have the shillty			
Knowledge	After passing this module the students have the ability	10:		
	 give an overview of the most important fields or 	process and bioprocess engineering,		
	explain some working methods for different field	ds in process engineering.		
Skills	After passing this module the students should have the	ability to:		
	 list and outline the most important fields of proc 	ess engineering.		
		or methods of the different fields of process engin	eerina	
	 read and prepare an engineering drawing, 		comg,	
	 explain the most important technologies for was 	towater and exhaust air treatment		
	 scheme typical chemical and biotechnological 			
	 scheme typical chemical and biotechnological 	processes independently with the aid of pointers.		
Personal Competence				
Social Competence	The students are able to			
	 work out results in groups and document them, 			
	 provide appropriate feedback and handle feedl 	back on their own performance constructively.		
Autonomy	The students are able to estimate their progress of	learning by themselves and to deliberate their	lack of knowledge in P	rococc Engineering and
Autonomy	Bioprocess Engineering.	learning by themselves and to deliberate them	lack of knowledge in F	Tocess Engineering and
	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): Spe	cialisation Process Engineering: Compulsorv		
Curricula	General Engineering Science (German program): Spe	0 0 1 ,		
	General Engineering Science (German program, 7 ser		npulsory	
	General Engineering Science (German program, 7 ser			
	Bioprocess Engineering: Core qualification: Compulso			
	General Engineering Science (English program): Spec	•		
	General Engineering Science (English program): Spec			
	General Engineering Science (English program). Spec		nulsory	
	General Engineering Science (English program, 7 sem	ester). Specialisation Bioprocess Engineering: C	Jompulsory	
	Process Engineering: Core qualification: Compulsory			

Course L0829: Introduction into Process Engineering/Bioprocess Engineering		
Тур	Lecture	
Hrs/wk	2	
CP	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.	
	0, 10	
Literature	s. Studie	



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
Literature	 Ceramic materials 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. Auflag 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)		Lecture	2	2
Physical Chemistry (L0835)		Laboratory Course	2	1
Module Responsible	Prof. Hans-Ulrich Moritz			
Admission Requirements	None			
Recommended Previous	Contents of the previous modules inorganic chemistry, physics fo	r engineers and mathematics I-III.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	g learning 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-, he	eat- and momentum transfer.		
	- to interpret phase diagrams and affiliate kinetic rate laws.			
Skills	The students are able to			
	- conduct (fundamental) thermodynamical, electrochemical and k	inetic calculations.		
	- assess new applications with respect to environmental sustaina	bility.		
	- abstract their knowldege to related issues to conduct thermodyn	amical, electrochemical and kinetic cal	culations.	
Personal Competence				
Social Competence	The students are able to plan, prepare, conduct and document ex	periments according to scientific guide	lines in small groups.	
	The students are able to reflect their subject-specific knowledge of	orally in a team and to discuss it with fel	llow students and faculty	
Autonomy	Students are able to assess their knowldege continuously on the	ir own by exemplified practice. Studen	ts 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			
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp Bioprocess Engineering: Core qualification: Elective Compulsory		liective Compulsory	
	General Engineering Science (English program): Specialisation R			
	General Engineering Science (English program): Specialisation R			
	General Engineering Science (English program): Specialisation a General Engineering Science (English program, 7 semester): Spi		nulsony	
	General Engineering Science (English program, 7 semester): Spi General Engineering Science (English program, 7 semester): Spi			
	Process Engineering: Core gualification: Compulsory	solansation bioprocess Engineering: El	iecave compulsory	
	roccos Engineering. Our quanication. Computorly			

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

Module Manual B. Sc. "General Engineering Science (German program)"



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			



Module M0536: Fundamen	tals 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 equations 			
	Integration			
Educational Objectives	After taking part successfully, students have reached the following lea	arning results		
Professional Competence				
Knowledge	Students are able to:			
	 explain the difference between different types of flow 			
	 give an overview for different applications of the Reynolds Tra 	Insport-Theorem in process enginee	erina	
	 explain simplifications of the Continuity- and Navier-Stokes-E 		•	
Skills	The students are able to			
	 describe and model incompressible flows mathematically 			
	 reduce the governing equations of fluid mechanics by simplifi 	cations to archive guantitative solution	ons e.g. by integration	
	 notice the dependency between theory and technical application 		0 7 0	
	 use the learned basics for fluid dynamical applications in field 	s of process engineering		
Personal Competence				
Social Competence	The students			
	 are capable to gather information from subject related, profess 	sional publications and relate that in	formation to the context (of the lecture and
	 able to work together on subject related tasks in small groups 	. They are able to present their resu	Its effectively in English	e.g. during small gr
	exercises)			
	are able to work out solutions for exercises by themselves, 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 known 	wledge with this literature,		
	 work on their exercises by their own and to evaluate their actu 	al 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 Pro			
Curricula	General Engineering Science (German program): Specialisation Bio			
	General Engineering Science (German program): Specialisation Ene			
	General Engineering Science (German program, 7 semester): Specia	,	-	
	General Engineering Science (German program, 7 semester): Specia			
	General Engineering Science (German program, 7 semester): Specia	alisation Energy and Enviromental E	ngineering: Compulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compuls	•		
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory			
	General Engineering Science (English program): Specialisation Ener		Jompulsory	
General Engineering Science (English program): Specialisation Process Engineering: 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 Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Special Technomathematics: Specialisation III. Engineering Science: Elective		igineening. Compuisory	
	Process Engineering: Core qualification: Compulsory	compulsory		
	riocess Engineering. Oure quamication. Computerry			



Тур	Lecture
Hrs/wk	2
CP	4
Workload in Hours	* Independent Study Time 92, Study Time in Lecture 28
	Prof. Michael Schlüter
Lecturer	
Language	DE
	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	1. Crowe, C. T.: Engineering fluid mechanics. Wiley, New York, 2009.
	2. Durst, F.: Strömungsmechanik: Einführung in die Theorie der Strömungen von Fluiden. Springer-Verlag, Berlin, Heidelberg, 2006.
	3. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994
	4. Herwig, H.: Strömungsmechanik: Eine Einführung in die Physik und die mathematische Modellierung von Strömungen. Springer Verlag, Ber
	Heidelberg, New York, 2006
	 Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage Gmb Wiesbaden, 2008
	6. Kuhlmann, H.C.: Strömungsmechanik. München, Pearson Studium, 2007
	 Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / Gl Fachverlage GmbH, Wiesbaden, 2009
	8. Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007
	9. Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Ber Heidelberg, 2008
	10. Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006
	11. van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882.
	12. White, F.: Fluid Mechanics, Mcgraw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011

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 Kicknung M.Q. Dürgensenschaft. Nächen Dennu Gi, die p. 2007
	 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.: Grenschicht-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



Courses				
Title		Тур	Hrs/wk	CP
Thermodynamics III (L0114)		Lecture	2	2
Thermodynamics III (L0140)		Recitation Section (small)	1	2
Thermodynamics III (L0142)		Recitation Section (large)	1	2
Module Responsible	Prof. Irina Smirnova			
Admission Requirements	None			
Recommended Previous	Mathematics, Physical Chemistry, Thermodynamic	cs I and II		
Knowledge				
Educational Objectives	After the line of the state of			
Educational Objectives	After taking part successfully, students have reach	led the following learning results		
Professional Competence				
Knowledge	 Starting from the very basics of thermodyna 	amics, the students learn the mathematical tools to de	scribe thermodynamic e	equilibria.
	They learn how state variables are influence	ced by the mixing of compounds and learn concepts to	quantitatively describe	these properties.
	 Moreover, the students learn how phase e 	quilibria can be described mathematically and which	phenomena may occur	if different phases (var
		more the fundamentals of reaction equilibria are taugh		
		mples relevant for different kinds of processes are sho		nowledge for plotting a
	interpreting the equilibria are taught.	····		
	molploting the equilibria are tadgita			
Skills	 Applying their knowledge, the students or 	re able to identify the correct equation for the daterm	notion of the equilibriu	m atata and know how
		re able to identify the correct equation for the determ	nation of the equilibriu	m state and know nov
	simplify these equations meaningfully.			
		used to determine the properties of the system in the	equilibrium state and	they are able to solve
	resulting mathematical relations.			
		self-reliantly find necessary physico-chemical properti	es of compounds as we	ell as model parameter
	literature sources.			
	 Beside pure compound properties the stud 	dents are capable of describing the properties of mixtu	res.	
	 The students know how to visualize phase 	equilibria graphically and they know how to interpret	the occurring phenome	na.
	 Based on their knowledge, the students 	are able to understand fundamental concepts that	are the basis for many	separation and react
	processes in chemical engineering.			
Personal Competence				
Social Competence	The students are able to work in small groups, to s	solve the corresponding problems and to present them	oraly to the tutors and	other students
Autonomy				
		formation self-reliantly in literature sources and to judg		
		to check their learning progress continuously in exer	cises. Based on this kn	owledge the students of
	adept their learning process.			
Workload in Hours	Independent Study Time 124. Study Time in Lectu	ire 56		
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes; theoretical questions and calculation	IS		
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): Specialisation Process Engineering: Con	npulsory	
	General Engineering Science (German program,	7 semester): Specialisation Bioprocess Engineering: C	Compulsory	
	Bioprocess Engineering: Core qualification: Comp	pulsory		
	General Engineering Science (English program):	Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program):			
		7 semester): Specialisation Process Engineering: Com	pulsory	
		7 semester): Specialisation Process Engineering: Control Process Engi		



Courses 0114: Thermodyremics	
Course L0114: Thermodynamics III	
Тур	
Hrs/wk	
CP	
Workload in Hours	
Lecturer	
Language	
Cycle	SoSe
Content	
	 Introduction: Applications of thermodynamics of mixtures Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule Equations of state: virial equations, van-der-Waals equation, generalized equations of state Mixing properties: ideal and real mixtures, excess properties, partial molar properties Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition Gas-liquid-equilibria: equilibrium condition, Henry-coefficient G^E-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems Solid-liquid-equilibria: equilibrium condition, binary systems Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature Osmotic pressure
Literature	 Jürgen Gmehling, Bårbel 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.

Typ Recitation Section (small) Hrs/Wt 1 CP 2 Workload in Hours Independent Study Time 46, Study Time in Lecture 14 Lecture Prof. Irina Smirnova Language DE 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. Maxing properties: ideal and real mixtures, excess properties, partial molar properties 6. Vapor-liquid-equilibria: equilibrium condition, Henry-coefficient 8. G ^E -Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQAC, UNIFAC 9. Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems 10. Solid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary 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, Bårbel Kolbe: Thermodynamik, VCH 1992	Course L0140: Thermodynamics III	
Image: constraint of the state of the s	Тур	Recitation Section (small)
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. G ^E -Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC 9. Liquid-liquid-equilibria: equilibrium condition, binary 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	Hrs/wk	1
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: equilibrium condition, Henry-coefficient 8. G ^E -Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC 9. Liquid-liquid-equilibria: equilibria: equilibria: equilibria: equilibria: equilibria: modition, binary systems 10. Solid-liquid-equilibria: equilibria:	CP	2
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 equations, chemical potential, fugacity 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 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.	Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
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. G ^E -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: equilibria: equilibrium condition, phase equilibria in binary and ternary 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.	Lecturer	Prof. Irina Smirnova
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. G ^E -Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC 9. Liquid-liquid-equilibria: equilibrium condition, binary 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	Language	DE
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: equilibrium condition, Henry-coefficient 7. Gas-liquid-equilibria: equilibrium condition, phase equilibria in binary systems 10. Solid-liquid-equilibria: equilibrium condition, phase equilibria in 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	Cycle	SoSe
		 Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule Equations of state: virial equations, van-der-Waals equation, generalized equations of state Mixing properties: ideal and real mixtures, excess properties, partial molar properties Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition Gas-liquid-equilibria: equilibrium condition, Henry-coefficient G^E-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary systems Solid-liquid-equilibria: equilibrium condition, binary systems Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature Osmotic pressure



Course L0142: Thermodynamics III	
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	 Introduction: Applications of thermodynamics of mixtures Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule Equations of state: virial equations, van-der-Waals equation, generalized equations of state Mixing properties: ideal and real mixtures, excess properties, partial molar properties Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition Gas-liquid-equilibria: equilibrium condition, Henry-coefficient G^E-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC Liquid-liquid-equilibria: equilibrium condition, binary systems Solid-liquid-equilibria: equilibrium condition, binary systems Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature 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: Thermodynamic Cambridge University Press, 2005.



	d Systems
ourses	
tle	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 sign
	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. T
	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	
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 lec
	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 Engineering, Science: Compulsory
ourricula	General Engineering Science (German program): Specialisation Porcess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Process Engineering: Computering: Computering
	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: 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 Mechatronics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering
	Compulsory
	Computer Science: Core qualification: Compulsory
	Electrical Engineering: Core qualification: 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 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
	deneral Engineering Science (English program, 7 semester). Specialisation Electrical Engineering. Compulsory
	General Engineering Science (English program, 7 semissie). Specialisation Electrical Engineering, 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 Process 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 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 Bioprocess 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 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 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 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 Mechanical Engineering, Focus Energy Systems: 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 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 Energy Systems: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems 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 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: Compulsor 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 General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
	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 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: Compulsor 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 General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science 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 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: Compulsor General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in 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 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 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 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: 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 (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: 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 General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering



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



Courses				
litle		Тур	Hrs/wk	CP
Bioprocess Engineering - Fundamentals (L	_0841)	Lecture	2	3
Bioprocess Engineering- Fundamentals (L	.0842)	Recitation Section (large)	2	1
Bioprocess Engineering - Fundamental Pra	actical Course (L0843)	Laboratory Course	2	2
Module Responsible	Prof. Andreas Liese			
Admission Requirements	none			
Recommended Previous	none, module "organic chemistry", module "fundamentals	s for process 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 b microorganisms, as well as to differentiate different types processes in bioreactors can be explained. The studen downstream processing in detail.	s of inhibition. The parameters of stoichiometry an	nd rheology can be na	amed and mass transp
Skills	 After successful completion of this module, students shou describe different kinetic approaches for growth a predict qualitatively the influence of energy gener analyze bioprocesses on basis of stoichiometry a distinguish between scale-up criteria for different well as to apply them to current biotechnical probl propose solutions to complicated biotechnologica to explore new knowledge resources and to apply identify scientific problems with concrete industria to document and discuss their procedures as well 	nd substrate-uptake and to calculate the correspon ation, regeneration of redox equivalents and grow nd to set up / solve metabolic flux equations bioreactors and bioprocesses (anaerobic, aerobic lem Il problems and to deduce the corresponding moo / the newly gained contents Il use and to formulate solutions.	vth inhibition on the fe	
Personal Competence Social Competence Autonomy	After completion of this module participants should be a own opinions and increase their capacity for teamwork in After completion of this module participants will be able present their results in a plenum.	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			
Assignment for the Following		lisation Process Engineering: Compulsory		
	General Engineering Science (German program): Specia			
		disation Bioprocess Engineering. Compulsory		
Curricula			llson	
	General Engineering Science (German program, 7 seme	ster): Specialisation Process Engineering: Compu		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme	ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Cor		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory	ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Cor		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (English program): Special	ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Cor lisation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (English program): Special General Engineering Science (English program): Special	ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Cor lisation Bioprocess Engineering: Compulsory lisation Process Engineering: Compulsory	npulsory	
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (English program): Special General Engineering Science (English program): Special General Engineering Science (English program, 7 semes	ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Cor lisation Bioprocess Engineering: Compulsory lisation Process Engineering: Compulsory ster): Specialisation Process Engineering: Compu	npulsory	
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (English program): Special General Engineering Science (English program): Special General Engineering Science (English program, 7 seme General Engineering Science (English program, 7 seme	ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Cor lisation Bioprocess Engineering: Compulsory lisation Process Engineering: Compulsory ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Com	npulsory	
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (English program): Special General Engineering Science (English program): Special General Engineering Science (English program, 7 semes General Engineering Science (English program, 7 semes Biomedical Engineering: Specialisation Artificial Organs	ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Cor lisation Bioprocess Engineering: Compulsory lisation Process Engineering: Compulsory ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Com and Regenerative Medicine: Compulsory	npulsory	
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (English program): Special General Engineering Science (English program): Special General Engineering Science (English program, 7 semes General Engineering Science (English program, 7 semes Biomedical Engineering: Specialisation Artificial Organs Biomedical Engineering: Specialisation Implants and Engineering	ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Cor lisation Bioprocess Engineering: Compulsory lisation Process Engineering: Compulsory ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Com and Regenerative Medicine: Compulsory doprostheses: Elective Compulsory	npulsory	
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (English program): Special General Engineering Science (English program): Special General Engineering Science (English program, 7 semes General Engineering Science (English program, 7 semes Biomedical Engineering: Specialisation Artificial Organs Biomedical Engineering: Specialisation Implants and Eng Biomedical Engineering: Specialisation Medical Technol	ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Cor lisation Bioprocess Engineering: Compulsory lisation Process Engineering: Compulsory ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Com and Regenerative Medicine: Compulsory doprostheses: Elective Compulsory ogy and Control Theory: Elective Compulsory	npulsory	
	General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (English program): Special General Engineering Science (English program): Special General Engineering Science (English program, 7 semes General Engineering Science (English program, 7 semes Biomedical Engineering: Specialisation Artificial Organs Biomedical Engineering: Specialisation Implants and Engineering	ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Com lisation Bioprocess Engineering: Compulsory lisation Process Engineering: Compulsory ster): Specialisation Process Engineering: Compu ster): Specialisation Bioprocess Engineering: Compu ster): Specialisation Bioprocess Engineering: Com and Regenerative Medicine: Compulsory doprostheses: Elective Compulsory ogy and Control Theory: Elective Compulsory d Business Administration: Elective Compulsory	npulsory	



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 Engineer	ring- 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	
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 M1274: Environme	ntal Technology			
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 follow	wing learning results		
Professional Competence		5 5		
Knowledge	With the completion of this module the students acquire in-de	nth knowledge of important cause-effect ch	ains of potential envir	onmental problems wh
Khowiedge	might occur from production processes, projects or construction			
	in dealing with different methods and instruments to assess			
	environmental processes as well as uncertainties and difficult			
Skills			at methods. Thereby i	they can develop suita
Skills	solutions for managing and mitigating environmental probl			
	independently and can apply the software programs OpenLC			
	to critically judge research results or other publications on env		g the course the stude	shis have the competer
		nonnenta mpaoto.		
Personal Competence				
Social Competence	The students are able to discuss the various technical and s	cientific tasks, both subject-specific and mu	ultidisciplinary. They a	are able to develop joi
	different solutions and to discuss their theoretical or practica	I implementation. Due to the selected lectu	re topics, the student	s receive insights into
	multi-layered issues of the environment protection and the	concept of sustainability. Their sensitivity a	and consciousness to	wards these subjects
	raised and which helps to raise their awareness of their future	social responsibilities in their role as engine	eers.	
Autonomy	The students learn to research, process and present a scien	tific topic independently. They are able to a	arry out independent	t scientific work. They c
	solve an environmental problem in a business context and are	e 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): Specialisat	on Energy and Enviromental Engineering: (Compulsory	
Curricula	General Engineering Science (German program): Specialisat	on Process Engineering: Elective Compulse	ory	
	General Engineering Science (German program, 7 semester)	Specialisation Energy and Enviromental En	ngineering: Compulso	ory
	General Engineering Science (German program, 7 semester)	Specialisation Process Engineering: Election	ve Compulsory	
	General Engineering Science (German program, 7 semester)	Specialisation Bioprocess Engineering: Ele	ective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compuls	ory		
	Energy and Environmental Engineering: Core qualification: C	ompulsory		
	General Engineering Science (English program): Specialisati	on Energy and Enviromental Engineering: C	Compulsory	
	General Engineering Science (English program): Specialisati	on Process Engineering: Elective Compulso	ry	
	General Engineering Science (English program, 7 semester):	Specialisation Energy and Enviromental En	igineering: Compulso	ry
	General Engineering Science (English program, 7 semester):	Specialisation Process Engineering: Electiv	e Compulsory	
	General Engineering Science (English program, 7 semester):	Specialisation Bioprocess Engineering: Ele	ctive Compulsory	
	Process Engineering: Core qualification: Elective Compulsory			
	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 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	



Module M0891: Informatics	for Process Engineers			
Courses				
Title		Тур	Hrs/wk	CP
Informatics for Process Engineers (L0836	i)	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 followi	ng learning results		
Professional Competence				
Knowledge	Students can describe procedural and object-oriented concepts	i.		
Skills Personal Competence Social Competence	Students are capable of object-oriented programming in the programing language Java and of solving mathematic questions by using Matlab. Students are capable of developing concepts (simple algorithms) to solve technical questions. 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): Specialisatio	n Process Engineering: Elective Compulso	ory	
Curricula	General Engineering Science (German program, 7 semester): S	pecialisation Energy and Enviromental Er	igineering: Elective Co	ompulsory
	General Engineering Science (German program, 7 semester): S	pecialisation Process Engineering: Elective	e Compulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Cor	npulsory		
	General Engineering Science (English program): Specialisation	Process Engineering: Elective Compulso	ry	
	General Engineering Science (English program, 7 semester): S	pecialisation Energy and Enviromental En	gineering: Elective Co	mpulsory
	General Engineering Science (English program, 7 semester): S	pecialisation Process Engineering: Electiv	e Compulsory	
	Process Engineering: Core qualification: Compulsory			



Course L0836: Informatics for Proce	ess Engineers
Тур	Lecture
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	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	 Programming in Matlab Numerical methods for systems of nonlinear equations Basics in computer arithmetic Linear and nonlinear optimization Condition of problems and algorithms 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 M0538: Heat and M	ass Transfer
Courses	
Title	Typ 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 Knowledge	Basic knowledge: Technical Thermodynamics
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence Knowledge	
	 The students are capable of explaining qualitative and determining quantitative heat transfer in procedural apparatus (e. g. heat exchance chemical reactors). They are capable of distinguish and characterize different kinds of heat transfer mechanisms namely heat conduction, heat transfer and the radiation. The students have the ability to explain the physical basis for mass transfer in detail and to describe mass transfer qualitative and quantitative using suitable mass transfer theories. They are able to depict the analogy between heat- and mass transfer and to describe complex linked processes in detail.
Skills	 The students are able to set reasonable system boundaries for a given transport problem by using the gained knowledge and to balance corresponding energy and mass flow, respectively. They are capable to solve specific heat transfer problems (e.g. heated chemical reactors, temperature alteration in fluids) and to calculate corresponding heat flows. Using dimensionless quantities, the students can execute scaling up of technical processes or apparatus. They are able to distinguish between diffusion, convective mass transition and mass transfer. They can use this knowledge for the description and design of apparatus (e.g. extraction column, rectification column). In this context, the students are capable to choose and design fundamental types of heat and mass exchanger for a specific applic considering their advantages and disadvantages, respectively. In addition, they can calculate both, steady-state and non-steady-state processes in procedural apparatus. The students are capable to connect their knowledge obtained in this course with knowlegde of other courses (In particular the court thermodynamics, fluid mechanics and chemical process engineering) to solve concrete technical problems.
Personal Competence Social Competence	• The students are capable to work on subject-specific challenges in teams and to present the results orally in a reasonable manner to tutors other students.
Autonomy	 The students are able to find and evaluate necessary information from suitable sources They are able to prove their level of knowledge during the course with accompanying procedure continuously (clicker-system, examassignments) and on this basis they can control their learning processes.
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): Specialisation Process Engineering: Compulsory
Curricula	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program): 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 Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
	Bioprocess Engineering: Core qualification: Compulsory
	Energy and Environmental Engineering: Core qualification: Compulsory
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory
	General Engineering Science (English program): Specialisation Process Engineering: 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 Energy and Enviromental Engineering: Compulsory
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory
	Technomathematics: Core qualification: Elective Compulsory
	Process Engineering: Core qualification: 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	 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

Course 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	paration Processes			
courses				
ïtle		Тур	Hrs/wk	CP
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	ng learning results		
Professional Competence				
Knowledge				
0	 The students can distinguish and describe different type 	s of separation processes such as distillatio	n, extraction, and ad	sorption
	• The students develop an understanding for the course of concentration during a separation process, the estimation of the energy demand of			
	process, the possibilities of energy saving, and the selec	ction of separation systems		
	 They have good knowledge of designing methods for set 			
Skills	 Using the gained knowledge the students can calcute a 	accorded aveter boundary for a given con	aration process and	ann alaga tha appagiat
	 Using the gained knowledge the students can select a r 	easonable system boundary for a given sep	paration process and	can close the associat
	energy and material balances			
	 The students can use different graphical methods for the 	designing of a separation process and defi	ne the amount of the	oretical stages require
	 They can select and design a basic type of thermal set 	paration process for a given case based of	on the advantages a	ind disadvantages of t
	process			
		adad matarial proportion from appropriate	aurooo (diagrama a	ad tables)
			sources (diagrams ar	id lables)
	 They can calculate continuous and discontinuous proce 	sses		
	 The students are able to prove their theoretical knowled 	ge in the experimental lab work.		
	 The students are able to discuss the theoretical backgro 	und and the content of the experimental wo	rk with the teachers i	n colloquium.
	The students are capable of linking their gained knowledge with	th the content of other lectures and use it to	ogether for the solution	on of technical problen
	Other lectures such as thermodynamics, fluid mechanics and cl	nemical engineering.		
Personal Competence				
Personal Competence				
Social Competence	 The students can work technical assignments in small g 	rouns and procent the combined results in th	ho tutorial	
	 The students can work technical assignments in small g 	roups and present the combined results in ti	ne lutorial	
	 The students are able to carry out practical lab work in 	small groups and organize a functional divi	ision of labor betwee	en them. They are able
	discuss their results and to document them scientifically	in a report.		
Autonomy				
	 The students are capable to obtain the needed informat 	on from suitable sources by themselves and	d assess their quality	
	 The students can proof the state of their knowledge with 	exam resembling assignments and in this w	vay control their learr	ning process
5471-1 ··· ··	Independent Onder Taxis CO. Other Time in the second			
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): 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	ompulsory	
	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester): 5	Specialisation Energy and Enviromental Eng	gineering: Compulso	ry
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Cor	npulsory		
	General Engineering Science (English program): Specialisation			
			maulaart	
	General Engineering Science (English program): Specialisation		mpulsory	
	General Engineering Science (English program): Specialisation	Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): S	pecialisation Process Engineering: Compul	sory	
			pulsory	
	General Engineering Science (English program, 7 semester): S	pecialisation Bioprocess Engineering: Com		
		pecialisation Bioprocess Engineering: Com		у



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	 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. Steinkopi 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



ourse L0119: Thermal Separation Processes		
Тур	Recitation Section (small)	
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	 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. 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 	



Тур	Recitation Section (large)
Hrs/wk	1
CP	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. 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



ourse L1159: Separation Process	
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 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 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



als) (L0204) als) (L0244) Fundamentals) (L0221) rof. Raimund Horn lone	Typ Lecture Recitation Section (large) Laboratory Course	Hrs/wk 2 2 2	CP 2 2
als) (L0244) Fundamentals) (L0221) rof. Raimund Horn Ione	Lecture Recitation Section (large)	2	2
als) (L0244) Fundamentals) (L0221) rof. Raimund Horn Ione	Lecture Recitation Section (large)	2	2
als) (L0244) Fundamentals) (L0221) rof. Raimund Horn Ione	Recitation Section (large)	2	
Fundamentals) (L0221) rof. Raimund Horn Ione			2
rof. Raimund Horn Ione		£	2
lone			-
antante of the provious modulos mathematics I III, physical de			
ontents of the previous modules mathematics i-in, physical ci	nemistry, technical thermodynamics I+II as we	ell as computational n	nethods for engineers.
fter taking part successfully, students have reached the follow	ring learning results		
he students are able to explain basic concepts of chemical re	eaction engineering. They are able to point o	ut differences betwee	en thermodynamical ar
inetical processes. The students have a strong ability to outlin	e parts of isothermal and non-isothermal ide	al reactors and to des	scribe their properties.
fter successful completion of the module, students are able to	:		
apply different computational methods to dimension isotherm	al and non-isothermal ideal reactors,		
determine and compute stable operation points for these read	ctors ,		
conduct experiments on a lab-scale pilot plants and documer	t these according to scientific guidelines.		
fter successful completition of the lab-course the students h	nave a strong ability to organize themselfes	in small groups to s	solve issues in chemic
eaction engineering. The students can discuss their subject re	lated knowledge among each other and with	their teachers.	
he students are able to obtain further information and asses	ss their relevance autonomously. Students of	can apply their know	Idege discretely to pla
repare and conduct experiments.			0 1
dependent Study Time 96, Study Time in Lecture 84			
/ritten exam			
20 min			
eneral Engineering Science (German program): Specialisatio	on Process Engineering: Compulsory		
eneral Engineering Science (German program): Specialisatio	on Bioprocess Engineering: Compulsory		
eneral Engineering Science (German program, 7 semester):	Specialisation Process Engineering: Compu	sory	
		-	
	,		
	n Bioprocess Engineering: Compulsorv		
		sorv	
		-	
	Specialization Disprototo Engineering. Outin	paracity	
	he students are able to explain basic concepts of chemical re- netical processes. The students have a strong ability to outlin fter successful completion of the module, students are able to apply different computational methods to dimension isotherm determine and compute stable operation points for these read conduct experiments on a lab-scale pilot plants and documer fter successful completition of the lab-course the students he action engineering. The students can discuss their subject re- he students are able to obtain further information and asser- repare and conduct experiments. dependent Study Time 96, Study Time in Lecture 84 ///itten exam 20 min eneral Engineering Science (German program): Specialisatio eneral Engineering Science (German program, 7 semester): ioprocess Engineering: Core qualification: Compulsory eneral Engineering Science (English program): Specialisatio eneral Engineering Science (English program): Specialisatio	netical processes. The students have a strong ability to outline parts of isothermal and non-isothermal idea fter 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 document these according to scientific guidelines. ther successful completition of the lab-course the students have a strong ability to organize themselfes the students are able to obtain further information and assess their relevance autonomously. Students of repare and conduct experiments. dependent Study Time 96, Study Time in Lecture 84 <i>Internal Engineering Science</i> (German program): Specialisation Process Engineering: Compulsory eneral Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program): Specialisation Process Engineering: Compulsory eneral Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program, 7 semester): Specialisation Bioproces	he students are able to explain basic concepts of chemical reaction engineering. They are able to point out differences between netical processes. The students have a strong ability to outline parts of isothermal and non-isothermal ideal reactors and to des ther 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 document these according to scientific guidelines. ther successful completition of the lab-course the students have a strong ability to organize themselfes in small groups to st action engineering. The students can discuss their subject related knowledge among each other and with their teachers. the students are able to obtain further information and assess their relevance autonomously. Students can apply their know repare and conduct experiments. dependent Study Time 96, Study Time in Lecture 84 tritten exam 20 min eneral Engineering Science (German program): Specialisation Process Engineering: Compulsory eneral Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory eneral Engineering Science (English program): Specialisation Bioprocess Engineering: Compuls

Course L0204: Chemical Reaction 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
	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



_	Engineering (Fundamentals)
· ·	Recitation Section (large)
Hrs/wk	2
CP Workload in Hours	2 Independent Study Time 22, Study Time in Lesture 29
Workload in Hours Lecturer	Independent Study Time 32, Study Time in Lecture 28 Prof. Raimund Horn, Dr. Oliver Korup
Language	DE
Cycle	WiSe
Content	
	and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentration, ma concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, convers 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, lir dependent and independent reactions, element-species-matrix, row reduced form of a matrix, rank of a matrix, Gauss Jordan elimination, rela 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, stand 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, chem equilibrium, activity, van't Hoff law, calculation of chemical equilibrium, principle of Le Chatelier and Braun, equilibrium calculations in multiple reac systems, 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 interested 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 reac single phase - biphasic- and multiphase reactors, batch-reactor, semi-batch reactor, CSTR, Plug Flow reactor, fixed bed reactor, adiabatic sta 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 var 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, m 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 exothe 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-isothe 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)



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	learning results		
Professional Competence				
Knowledge	With the completion of this modul the students obtain profound	knowledge of environmental technological	ogy. They are able to d	escribe the behaviour c
	chemicals in the environment. Students can give an overview of	f scientific disciplines involved. They	can explain terms and	allocate them to relate
	methods.			
01.114			bland Theorem able to	determine a set este set e
Skills	Students are able to propose appropriate management and mitig			-
	parameters and to assess the potential of pollutants to migrat			
	Environmental Technology contributes to sustainable development	it, and they can present and delend in	ese opinons in ironi oi a	nd against the group.
Personal Competence				
Social Competence	The students are able to discuss the various technical and scient	ific tasks, both subject-specific and mu	Iltidisciplinary. They are	able to develop differer
	approaches to the task as a group as well as to discuss their theoretical or practical implementation.			
Autonomy	Students can independently explait services about of the subject.	activity the perticular knowledge and t	ranfar it ta naw problem	-
Autonomy	Students can independently exploit sources about of the subject, a	acquire the particular knowledge and t	ramer it to new problem	5.
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 E	Energy and Enviromental Engineering	: Compulsory	
Curricula	General Engineering Science (German program): Specialisation F	Process Engineering: Elective Compul	sory	
	General Engineering Science (German program, 7 semester): Spe	ecialisation Energy and Enviromental I	Engineering: Compulso	ŷ
	General Engineering Science (German program, 7 semester): Spe	ecialisation Process Engineering: Elec	tive Compulsory	
	General Engineering Science (German program, 7 semester): Spe	ecialisation Bioprocess Engineering: E	lective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsory			
	Energy and Environmental Engineering: Core qualification: Comp	ulsory		
	General Engineering Science (English program): Specialisation E	nergy and Enviromental Engineering:	Compulsory	
	General Engineering Science (English program): Specialisation P	rocess Engineering: Elective Compuls	sory	
	General Engineering Science (English program, 7 semester): Spe	cialisation Energy and Enviromental E	Engineering: Compulsor	у
	General Engineering Science (English program, 7 semester): Spe	cialisation Process Engineering: Elect	ive Compulsory	
	General Engineering Science (English program, 7 semester): Spe	cialisation Bioprocess Engineering: El	ective 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 Techr	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	 Introductory seminar on environmental science: Environmental impact and adverse effects Wastewater technology Air pollution control Noise protection Waste and recycling management Soil and ground water protection Renewable energies Resource conservation and energy efficiency Förster, U.: Umweltschutztechnik; 2012; Springer Berlin (Verlag) 8., Aufl. 2012; 978-3-642-22972-5 (ISBN)



Module M0956: Measureme	ent Technology for Mechanical and Proc	cess Engineers		
Courses				
Title		Тур	Hrs/wk	CP
Practical Course: Measurement and Cont	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 e	engineering		
Knowledge		ha fallan fan hannefer oan he		
Educational Objectives	After taking part successfully, students have reached t	he following learning results		
Professional Competence				
Knowledge	Students are able to name the most important fundm	entals of the Measurement Technology (Quantitie	s and Units, Uncertain	ty, Calibration, Static a
	Dynamic Properties of Sensors and Systems).			
	They can outline the most important measuring metho	ods for different kinds of quantities to be maesured	(Electrical Quantities,	Temperature, mechanic
	quantities, Flow, Time, Frequency).			
	The second se			
	They can describe important methods of chemical Ana	alysis (Gas Sensors, Spectroscopy, Gas Chromato	graphy)	
01.71			ter ter e ter en ettere	
Skills	Students can select suitable measuring methods to give	ven problems and can use refering measurement of	devices in practice.	
	The students are able to orally explain issues in the s	subject area of measurement technology and solu	tion approaches as we	I as place the issues ir
	the right context and application area.			
Personal Competence				
Social Competence	Students can arrive at work results in groups and docu	ument them in a common report.		
Autonomy	Students are able to familiarize themselves with new r	neasurement technologies.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 7	0		
Credit points	6			
Examination	Written exam			
Examination duration and scale	105 minutes			
Assignment for the Following	General Engineering Science (German program): Spe	ecialisation Energy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Spe	ecialisation Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Spe	ecialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Spe	ecialisation Process Engineering: Compulsory		
	General Engineering Science (German program, 7 se	mester): Specialisation Energy and Enviromental E	Engineering: Compulso	ory
	General Engineering Science (German program, 7 se	mester): Specialisation Mechanical Engineering: C	Compulsory	
	General Engineering Science (German program, 7 se	mester): Specialisation Biomedical Engineering: C	ompulsory	
	General Engineering Science (German program, 7 se	mester): Specialisation Process Engineering: Com	pulsory	
	Energy and Environmental Engineering: Core qualific	ation: Compulsory		
	General Engineering Science (English program): Spe		Compulsory	
	General Engineering Science (English program): Spe			
	General Engineering Science (English program): Spe			
	General Engineering Science (English program): Spe			
	General Engineering Science (English program, 7 ser	, , , , , , , , , , , , , , , , , , , ,		ry
	General Engineering Science (English program, 7 ser			
	General Engineering Science (English program, 7 ser			
	General Engineering Science (English program, 7 ser	,	oulsory	
	Mechanical Engineering: Core qualification: Compuls	ory		
	Mechatronics: Core qualification: Compulsory			
	Process Engineering: Core qualification: Compulsory			



ourse L1119: Practical Course: Me	asurement and Control Systems
Тур	Laboratory Course
Hrs/wk	2
CP	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 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
	 Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftlicher 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 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 Jan Lunze: Systemtheoretische Grundlagen, Analyse und Entwurf einschleifiger Regelungen



Course L1116: Measurement Technol	ology for Mechanical and Process Engineers
Тур	Lecture
Hrs/wk	2
-	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Sven Krause DE
Cycle	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.

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 M0539: Process an	d Plant Engineering I			
Courses				
Title		Turn	Hrobule	CP
		Typ	Hrs/wk 2	2
Process and Plant Engineering I (L0095) Process and Plant Engineering I (L0096)		Lecture Recitation Section (large)	2	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	g results		
Professional Competence				
Knowledge	students can:			
	classify and formulate blobal balance equations of chemical processes			
	specify linear component equations of complex chemical processes			
	explain linear regression and data reconcilliation problems			
	explain pfd-diagrams			
Skills	students are capable of			
	- formulation of mass and energy balance equations and estimation of pro	oduct streams		
	- estimation of component streams of chemical plants using linear compo	nent balance models		
	- solution of data reconcilliation tasks			
	- conduction of process synthesis			
	- economic evaluation of processes and the estimation of production cost	5		
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 Bioproce	ess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisat	ion Process Engineering: Compul	sory	
	General Engineering Science (German program, 7 semester): Specialisat	ion Bioprocess Engineering: Com	pulsory	
	General Engineering Science (German program, 7 semester): Specialisat	ion Energy and Enviromental Eng	ineering: Elective Co	mpulsory
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Bioproce	ss Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Process	Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisati		sory	
	General Engineering Science (English program, 7 semester): Specialisati		-	
	General Engineering Science (English program, 7 semester): Specialisati		-	mpulsory
	Process Engineering: Core qualification: Compulsory		-	
	0 0 1			

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	 Introduction Structure and operation of production plants Operational business process Technical process design Motivation and targets of process development Life cycle of production plants 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 (German program)"

_			 	
			<u> </u>	
	L U			

1	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	
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
	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	ecitation Section (large)		
Hrs/wk			
CP	2		
Workload in Hours	dependent Study Time 46, Study Time in Lecture 14		
Course work	ne		
Lecturer	Prof. Georg Fieg		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		



Course L1214: Process and Plant Engineering I			
Тур	ecitation Section (small)		
Hrs/wk			
CP			
Workload in Hours	independent Study Time 46, Study Time in Lecture 14		
Course work	ione		
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)		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 	rocess engineering.			
	 characterize particles, particle distributions and to discuss the 				
Skills	Students are able to				
	choose and design apparatuses and processes for solids processing according to the desired solids properties of the product				
 asses solids with respect to their behavior in solids processing 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 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 Pro	cess Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisation Bio	process Engineering: Compulsory			
	General Engineering Science (German program): Specialisation Ene				
	General Engineering Science (German program, 7 semester): Specia				
	General Engineering Science (German program, 7 semester): Specia				
	General Engineering Science (German program, 7 semester): Specia	alisation Energy and Enviromental Er	ngineering: Compulsory	/	
	Bioprocess Engineering: Core qualification: Compulsory				
	Energy and Environmental Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Prod General Engineering Science (English program, 7 semester): Specia		leory		
			•		
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory				
	Process Engineering: Core gualification: Compulsory	and Environmental En	gineering. compulsoly		
	riocos Engineering. Oore quanication. Oompuisoly				



Course L0434: Particle Technology			
Тур			
Hrs/wk	3		
CP			
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	1		
Тур	Laboratory Course		
Hrs/wk			
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.		



ourses				
tle		Тур	Hrs/wk	CP
roduction to Management (L0880)		Lecture Problem-based Learning	3	3 3
oject Entrepreneurship (L0882)	Duck Christen h lbl	Problem-based Learning	2	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous Knowledge	Basic Knowledge of Mathematics and Business			
Educational Objectives	After taking part successfully, students have reached the follo	wing learning results		
Professional Competence	The lang part bubbles any, state is in the reaction are is in			
Knowledge	After taking this module, students know the important basics Marketing and Innovation, and also to Investment and Contro		nagement, from Planı	ning and Organisation
Personal Competence	 explain the differences between Economics and Manifield of Management explain the most important aspects of and goals in Mail describe and explain basic business functions as privessource management, information and selected students are able to analyse business units with respert Entrepreneurship project in a team. In particular, they are able analyse Management goals and structure them approving analyse organisational and staff structures of companing apply methods for decision making under multiple objic analyse production and procurement systems and Build analyse and apply basic methods for marketing select and apply basic methods form mathematical fining apply basic methods from accounting, costing and constructions and procurement systems and bring apply basic methods from mathematical fining apply basic methods from accounting, costing and constructions and procurement systems and bring apply basic methods from accounting and constructions and procurement apply basic methods from accounting and constructions are able to 	nagement and name the most important aspe- oduction, procurement and sourcing, supply novation management and marketing ing in Business, esp. in situations under mu l controlling methods. And the different criteria (organization, object e to priately les ectives, under uncertainty and under risk siness information systems ance to predefined problems	ects of entrepmeurial p chain management, o Itiple objectives and	projects organization and hum uncertainty, and expl.
Autonomy	 work successfully in a team of students to apply their knowledge from the lecture to an entrep to communicate appropriately and to cooperate respectfully with their fellow students. 	eneurship project and write a coherent repor	t on the project	
	work in a team and to organize the team themselvesto 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): Specialisat	ion Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisat	ion Computer Science: Compulsory		
	General Engineering Science (German program): Specialisat	ion Process Engineering: Compulsory		
	General Engineering Science (German program): Specialisa	1 0 0 1 ,		
	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)		ulsory	
	General Engineering Science (German program, 7 semester)	: Specialisation Process Engineering: Compu	Ilsory	
	General Engineering Science (German program, 7 semester)	: Specialisation Biomedical Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester)	: Specialisation Naval Architecture: Compulse	ory	
	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)	: Specialisation Mechanical Engineering, Foo : Specialisation Mechanical Engineering, Foo : Specialisation Mechanical Engineering, Foo	eus Mechatronics: Cor eus Biomechanics: Co eus Aircraft Systems E	npulsory mpulsory ngineering: Compulso



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
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 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 Energy and Enviromental 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 Enviromental 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 Science
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: 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 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.	

Ξ



Thesis

Module M-001: Bachelor Thesis	
•	
Courses	
Title	Typ Hrs/wk CP
Module Responsible	Professoren der TUHH
Admission Requirements	According to General Regulations §24 (1):
	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	
	• 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	
	 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 that is appropriate to the addresses 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	
	 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 called to identify and you and connect knowledge and meterial processory for working on a calculation.
	 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