

Module Manual

Bachelor of Science

General Engineering Science (English program, 7 semester)

Cohort: Winter Term 2016

Updated: 24th November 2016

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Program description

Content

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

Career prospects

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

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

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

Learning target

Knowledge

Students can:

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

Skills

Graduates are able to

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

Social Competence

Graduates are able to

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

Autonomy

Graduates are able to

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

Program structure

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





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



Core qualification

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

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



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

Course L0	Course L0469: Chemistry (GES) II		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload	Independent Study Time 32, Study Time in Lecture 28		
in Hours			
Lecturer	Dr. Christoph Wutz		
Language	EN		
Cycle	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	- Gallagher, Ingram: Complete Chemistry (Oxford University Press)		
	- Corwin: Introductory Chemistry (Pearson) - Burrows, Parsons, Price, Holman: Chemistry3 (Oxford University Press)		

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



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

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



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



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



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

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



Module M0736: Linear Alge	ebra			
Courses				
Title		Тур	Hrs/wk	СР
Linear Algebra (L0642)		Lecture	4	4
Linear Algebra (L0643)		Recitation Section (large)	2	2
Linear Algebra (L0645)		Recitation Section (small)	2	2
Module Responsible	Prof. Marko Lindner			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached to	ne following learning results		
Professional Competence				
Knowledge Skills	 Students can name the basic concepts in 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 examples. They know proof strategies and can reproduce them. Students can model problems in linear algebra with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods. Students are able to discover and verify further logical connections between the concepts studied in the course. For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results. 			
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 128, Study Time in Lecture 1	12		
Credit points	8			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	Computer Science: Core qualification: Compulsory			
Curricula	General Engineering Science (English program): Core	qualification: Compulsory		
	General Engineering Science (English program, 7 sen	nester): Core qualification: Compulsory		

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

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



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



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

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



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



Module M1139: Physics for	Engineers (GES)			
Courses				
Title		Тур	Hrs/wk	CP
Physics for Engineers (GES) (L0557)		Lecture	2	3
Physics for Engineers (GES) (L0560)		Recitation Section (small)	1	1
Module Responsible	Dr. Alexander Petrov			
Admission Requirements	None			
Recommended Previous	Calculus and linear algebra on high school level			
Knowledge	Physics on high school level			
	Triyalda diriligir aciloonlever			
Educational Objectives	After taking part successfully, students have reached the fo	lowing learning results		
Professional Competence				
Knowledge	Students can explain fundamental topics and laws of physi	cs such as in the areas of mechanics, oscilla	tions,	
	waves, and optics.			
	Children and an analysis of the state of the			
Chille	Students can relate physics topics to technical problems.			
Skills	Students can describe physical problems mathematically and solve such problems within the framework of their acquired mathematical expertise.			
	their acquired mathematical expentise.			
Personal Competence				
Social Competence	Students can jointly solve subject related problems in groups. They can present their results effectively			
	within the framework of the problem solving courses.			
Autonomy	Students are capable to extract relevant information from	the provided references and to relate this in	formation to the content	of the lecture. They can
Autonomy	reflect their acquired level of expertise with the help of le	•		•
	connect their knowledge with that acquired from other lectu		ani typicai exam questic	iis. Olddeilis are able to
	connect their knowledge with that acquired from other recto	166.		
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42			
Credit points	4			
Examination	Written exam			
Examination duration and scale	120 min, 10 problems with two parts a) and b) plus physics	lab attestation		
Assignment for the Following	General Engineering Science (English program): Core qua	lification: Compulsory		
Curricula	General Engineering Science (English program, 7 semeste	r): Core qualification: Compulsory		

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



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



management, collaboration and professional and personnel management competences. The department implements these training objectives teaching architecture, in its teaching and learning arrangements, in teaching areas and by means of teaching offerings in which students can obly opting for specific competences and a competence level at the Bachelor's or Master's level. The teaching offerings are pooled in two difficults of the Control of	ule M0577: Nontechnic	cal Complementary Courses for Bachelors
Recommended Previous Educational Objectives After tailing part successfully, students have reached the following learning results Professional Competence **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-reliance management, collaboration and professional and personnel management competences. The department implements these training objectives teaching architecture, in its beaching and learning arrangements, in technique area and owness of teaching derings in which students can be catallogues for nontechnical complementary courses. The Learning Architecture consists of a cross-disciplinarily study offering. The centrality designed leaching offering ensures that courses in the "non-technical department" fulls aspecial crossing of TUHH degree courses. The learning architecture demands and rains independent educational planning as regards the individual development of competences. It also provisitations knowledge in the form of 'profiles' The subjects that can be skildled in parallel throughout the student's entire skelp program - if need be, it can be skildled in one to two senseties. If of the adaption problems the individuals commonly form is their first semesters after mething the transition from school to university and in one nonzourage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters during the countries of the adaption problems the individuals commonly for in their first semesters after mething the transition from school to university and in one nonzourage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters during the countries of the adaption problems the individuals commonly for in the internet seminary objects with the seminary of semesters. The challenge of dealing with interdisciplinaria of traching area to see the dealing area agr	Module Responsible	Dagmar Richter
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Educational Objectives Professional Competence 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-reliance management, collaboration and professional and personnel management competences. The department implements these valuing objectives teaching architecture, in its eaching and exempting arrangements, in teaching area are mit implements where valuing objectives teaching architecture are trained by opting for specific competences and a competence level at the Bachelor's or Master's level. The teaching offerings in which students can obly opting for specific competences and a competence level at the Bachelor's or Master's level. The teaching offerings are pooled in two did catalogues for noncentralical complementary courses. The Learning Architecture consists of a cross disciplinarity skuldy offering. The centrally designed teaching offering ensures that courses in the "non-technical department" folic specific profiling of TUHH degree courses. The learning architecture demands and trains independent educational planning as regards the individual development of competences. It also provides the study program and the study program in freed be, it can be studied in one to two semesters. It is not of the adaptation profilers that individuals commonly face in their inter emesters after study program—in need be, it can be studied in one to two semesters. It is no concurrage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters are interested 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, aris, historical studies, communication studies sustainability research, and from engineering diduction, in addition, from the winter	Recommended Previous	None
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by oping for specific competences and a competence level at the Bachelor's or Master's level. The teaching offerings are pooled in two discatalogues for nontechnical complementary courses. The Learning Architecture ansists of a cross-disciplinarily study offering. The centrally designed teaching offering ensures that courses in the "non-technical department" folic specific profiling of TUHH degree courses. The learning architecture demands and trains independent educational planning as regards the individual development of competences. It also provides that can be studied in parallel throughout the student's entire study program - if need be, it can be studied in one to two semesters. In other dapptation problems that individuals commonly face in their first semesters after making the transition from school to university and in one nonurage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters during the coustudes. 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 interdisciple 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, ans, historical studies, communication studies sustainability research, and from engineering didactics. In addition, from the winter semester 2014/15 students on all Bachelor's courses will have opportunity to learn about business management and start-ups in a goal-oriented way. The fields of teaching are augmented by soft skills offers and a foreign language offer. Here, the focus is on encouraging goal-oriented communication in the B.Sc. This is also reflected in the different puality of soft skills, which relate to the different team positions and different group leadership functions of Bach and		imparts skills that, in view of the TUHH's training profile, professional engineering studies require but are not able to cover fully. Self-reliance, management, collaboration and professional and personnel management competences. The department implements these training objectives
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of the adaptation problems that individuals commonly face in their first semesters after making the transition from school to university and in or encourage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters during the coustudies. 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 interdisciplic 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 studies sustainability research, and from engineering didactics. In addition, from the winter semester 2014/15 students on all Bachelor's courses will have 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 community 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 refl in the practical examples used, in content topics that refer to different professional application contexts, and in the higher scientific and theoretical eabstraction 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 Bach 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 outlines of how scientific disciplines, paradigms,		The learning architecture demands and trains independent educational planning as regards the individual development of competences. It also provorientation knowledge in the form of "profiles"
provide for students, separated into B.Sc. and M.Sc., to learn with and from each other across semesters. The challenge of dealing with interdiscipli 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 studies sustainability research, and from engineering didactics. In addition, from the winter semester 2014/15 students on all Bachelor's courses will have 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 communic 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 refl in the practical examples used, in content topics that refer to different professional application contexts, and in the higher scientific and theoretical le 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 Bach 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 spec		The subjects that can be studied in parallel throughout the student's entire study program - if need be, it can be studied in one to two semesters. In of the adaptation problems that individuals commonly face in their first semesters after making the transition from school to university and in ord encourage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters during the cour studies.
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		1

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

Personal Competence

Social Competence | Personal Competences (Social Skills)

Students will be able

- to learn to collaborate in different manner,
- to present and analyze problems in the abovementioned fields in a partner or group situation in a manner appropriate to the addressees,
- to express themselves competently, in a culturally appropriate and gender-sensitive manner in the language of the country (as far as this studyfocus 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

C	o	u	r	s	е	s	
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Information regarding lectures and courses can be found in the corresponding module handbook published separately.



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



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

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

Course L0441: Technical 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 M0594: Fundament	tals of Mechanical Engineering Design				
Courses					
Title		Тур	Hrs/wk	CP	
Fundamentals of Mechanical Engineering		Lecture	2	3	
Fundamentals of Mechanical Engineering	· · · · · · · · · · · · · · · · · ·	Recitation Section (large)	2	3	
Module Responsible	Prof. Dieter Krause				
Admission Requirements	None				
Recommended Previous	Basic knowledge about mechanics and production engineering				
Knowledge	Internship (Stage I Practical)				
Educational Objectives	After taking part successfully, students have reached the following learning	g results			
Professional Competence					
Knowledge	After passing the module, students are able to:				
	 explain basic working principles and functions of machine elemen 	ts,			
	 explain requirements, selection criteria, application scenarios ar 	nd practical examples of basic m	achine elements, indi	cate the background of	
	dimensioning calculations.				
Chille	After a consistent the annual state of the s				
Skills	After passing the module, students are able to:				
	 accomplish dimensioning calculations of covered machine element 	nts,			
	 transfer knowledge learned in the module to new requirements an 	d tasks (problem solving skills),			
	recognize the content of technical drawings and schematic sketches,				
	technically evaluate basic designs.				
Personal Competence					
Social Competence					
	Students are able to discuss technical information in the lecture su	pported by activating methods.			
Autonomy					
,	Students are able to independently deepen their acquired knowledge.	-			
	 Students are able to acquire additional knowledge and to reca 	pitulate poorly understood conte	ent e.g. by using the v	video recordings of the	
	lectures.				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56				
Credit points	6				
Examination	Written exam				
Examination duration and scale	120				
Assignment for the Following	General Engineering Science (German program): Core qualification: Com	npulsory			
Curricula	General Engineering Science (German program, 7 semester): Core qualit	ication: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Core qualification: Com	pulsory			
	General Engineering Science (English program, 7 semester): Core qualifi	cation: Compulsory			
	Logistics and Mobility: Core qualification: Compulsory				
	Mechanical Engineering: Core qualification: Compulsory				
	Mechatronics: Core qualification: Compulsory				
	Naval Architecture: Core qualification: Compulsory				
	Technomathematics: Specialisation III. Engineering Science: Elective Cor	mpulsory			
	Technomathematics: Core qualification: Elective Compulsory				



Course L0258: Fundamentals of Me	chanical Engineering Design
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 the following machine elements Screws Shaft-hub joints Rolling contact bearings Welding / adhesive / solder joints Springs Axes & shafts Presentation of technical objects (technical drawing)
	Calculation methods for dimensioning the following machine elements:
	• Springs
	Axis & shafts
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 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 M0772: Electrical E	ngineering II			
Courses				
Title		Тур	Hrs/wk	CP
Electrical Engineering II (L0747)		Lecture	3	5
Electrical Engineering II (L0748)		Recitation Section (small)	2	1
Module Responsible	NN			
Admission Requirements	None			
Recommended Previous	Content of the Lecture "Electrical Engineering I (Elektrotechnik I)"			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the followin	g learning results		
Professional Competence				
Knowledge	The students know the basic theory, relations and methods of t	ime dependent network theory and basic	nonlinear circuit ele	ments. This includes, in
	particular:			
	• transients,			
	the use of complex numbers and phasors, the concept of impedance			
	and democratic mipodamos;			
	steady state sinusoidal circuit analysis, appropriate and 2 phase systems.			
	 complex power and 3-phase systems, transformers, 			
	 transfer function and filters, 			
	the concept of resonance,			
	 diodes and rectifiers, 			
	bipolar transistors and operational amplifiers			
	- Sipolar Bansistors and operational amplinors			
Skills	The students are able to establish relations between time dependent currents and voltages in linear networks. The students know how to apply network			
	theory to analyze 3-phase systems, transformers, filter-like structures, and resonating networks. The students know to include basic nonlinear circuit			
	elements, such as diodes, bipolar transistors, and operational an	nplifiers, into the network analysis.		
Personal Competence				
Social Competence	Students are able to colve enecific problems, close or in a group	and to present the results assertingly. Ct.	udente can avalais as	ncente and on the basis
Suciai Competence	Students are able to solve specific problems, alone or in a group of examples and exercises, verify and deepen their understanding		udenis can explain co	incepts and, on the basis
	or examples and exercises, verify and deepen their understanding	ig.		
Autonomy	Students are able to acquire particular knowledge using textbook	oks in a self-learning process, to integrate	e, present, and assoc	iate this knowledge with
	other fields. The students develop persistency to also solve more	complicated problems.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes			
	General Engineering Science (English program): Core qualificati	ion: Compulsory		
Assignment for the Following Curricula	General Engineering Science (English program, 7 semester): Co			
Curricula	deneral Engineering Science (English program, 7 semester): Co	ne quannoanom. Compuisory		

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



Course L0748: Electrical Engineering	ng II
Тур	Recitation Section (small)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	NN
Language	EN
Cycle	SoSe
Content	The exercise sessions serve to deepen the understanding of the concepts of the lecture.
Literature	 A.R. Hambley: "Electrical Engineering", 5th ed., (Pearson, 2011) M. Albach: "Elektrotechnik", (Pearson, 2011).



Module M0737: Mathematic	al Analysis			
	,			
Courses				
Title		Тур	Hrs/wk	СР
Mathematical Analysis (L0647)		Lecture	4	4
Mathematical Analysis (L0648)		Recitation Section (large)	2	2
Mathematical Analysis (L0649)		Recitation Section (small)	2	2
Module Responsible	Prof. Marko Lindner			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	he following learning results		
Professional Competence				
Knowledge Skills	 Students can name the basic concepts in analysis. 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 examples. They know proof strategies and can reproduce them. Students can model problems in analysis with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods. Students are able to discover and verify further logical connections between the concepts studied in the course. For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results. 			
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 128, Study Time in Lecture 1	12		
Credit points	8			
Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following	Computer Science: Core qualification: Compulsory			
Curricula	General Engineering Science (English program): Core	e qualification: Compulsory		
	General Engineering Science (English program, 7 sen	nester): Core qualification: Compulsory		

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

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



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



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



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

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



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



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

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

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



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



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

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

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

Course L1031: Differential 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 Introduction and elementary methods Exsitence and uniqueness of initial value problems Linear differential equations Stability and qualitative behaviour of the solution Boundary value problems and basic concepts of calculus of variations Eigenvalue problems Numerical methods for the integration of initial and boundary value problems Classification of partial differential equations	
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html	



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

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



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

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



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

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



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



Specialization Civil Engineering

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

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

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

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



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

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



Module M0740: Structural A	Analysis I			
Courses				
Title		Тур	Hrs/wk	СР
Structural Analysis I (L0666)		Lecture	2	3
Structural Analysis I (L0667)		Recitation Section (large) 2 3		
Module Responsible	Prof. Uwe Starossek			
Admission Requirements				
	none			
Recommended Previous	Mechanics I, Mathematics I			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learnin	g results		
Professional Competence				
Knowledge	After successfully completing this module, students can express the basic	aspects of linear frame analysis of	statically determina	te systems.
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 determinate plane and spatial frame and truss structures.			
Personal Competence				
Social Competence				
essai sempelenes				
Autonomy	The students are able work in-term homework assignments. Due to the in	n-term feedback, they are enabled t	o self-assess their	earning progress during
	the lecture period, already.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisation Civil- and	d Environmental Engangering: Comm	vulcon/	
Curricula	General Engineering Science (German program). Specialisation Civil- and General Engineering Science (German program, 7 semester): Specialisation		Juisory	
Garricula	Civil- and Environmental Engineering: Core qualification: Compulsory	.c c.vii Enginocinig. Compulsory		
	General Engineering Science (English program): Specialisation Civil- and	d Enviromental Engeneering: Comp	ulsorv	
	General Engineering Science (English program, 7 semester): Specialisation		a,	
	Technomathematics: Specialisation III. Engineering Science: Elective Cor			

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 M0590: Building Ma	aterials and Building Chemistry			
Courses				
Title		Тур	Hrs/wk	СР
Building Materials and Building Chemistry	(L0248)	Lecture	4	4
Building Materials and Building Chemistry	(L0249)	Recitation Section (small)	1	2
Module Responsible	Prof. Frank Schmidt-Döhl			
Admission Requirements	None			
Recommended Previous	Module Principles of Building Materials and Building Ph	ysics		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	The students are able to explain the most important co	emponents, the manufacture, the structure, the	most important characte	eristics of the mechanical
	behaviour and the corrosion behaviour, the material tes	ting and the fields of utilization of all relevant bu	ilding materials.	
Skills	The students are able to assess the usability of building	• • • • • • • • • • • • • • • • • • • •	-	
	advantages and disadvantages. The students are able actual rules and the connections between the char			
	avoid damage processes.	aciensiic concrete parameters. They are abi	e to select suitable III	ateriais and mixtures to
	avoid damage processes.			
Personal Competence				
Social Competence	The students are able to support each other to learn to	he very extensive specialist knowledge in lea	rning groups and to car	rry out exercises in small
	groups in the lab.			
Autonomy				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	2 stündige Klausur			
Assignment for the Following	General Engineering Science (German program, 7 sem-	ester): Specialisation Civil Engineering: Compu	Isory	
Curricula	Civil- and Environmental Engineering: Core qualification	n: Compulsory		
	General Engineering Science (English program, 7 seme	ester): Specialisation Civil Engineering: Compul	sory	

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

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



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

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



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

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



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

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

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



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



Courses Title Typ Hrs/wk CP Structural Analysis II (L0573) Lecture 2 3 Structural Analysis II (L0574) Prof. Uwe Starossek Admission Requirements None Recommended Previous Knowledge Mathematics III Mathematics III Mathematics III Mathematics III Mitter taking part successfully, students have reached the following learning results Professional Competence Knowledge After successful completion of this module, students are able to analyze state variables and to construct influence lines of statically indermit and spatial frame and truss structures.	
Title Structural Analysis II (L0673) Structural Analysis II (L0674) Module Responsible Admission Requirements Knowledge Knowledge Knowledge After successful completion of this module, students are able to analyze state variables and to construct influence lines of statically inderminations of the statically indermination of the statically indermination of this module, the students are able to analyze state variables and to construct influence lines of statically inderminations of the statically indermination of the statical of the sta	
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Module Responsible	
Admission Requirements Recommended Previous Knowledge Mechanics I/II Mathematics I/II Differential Equations I Structural Analysis I Educational Objectives Professional Competence Knowledge After successful completion of this module, students are able to analyze state variables and to construct influence lines of statically indermin	
Recommended Previous Knowledge Mathematics I/II Mathematics I/II Mathematics I/II Structural Analysis I Educational Objectives Professional Competence Knowledge After successful completion of this module, students are able to analyze state variables and to construct influence lines of statically indermin	
Mechanics //I Mathematics //II Differential Equations I Structural Analysis I Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge After successful completion of this module, students can express the basic aspects of linear frame analysis of statically indeterminate systems. Skills After successful completion of this module, the students are able to analyze state variables and to construct influence lines of statically inderminate.	
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Skills After successful completion of this module, the students are able to analyze state variables and to construct influence lines of statically indermi	
	nate plane
Personal Competence	
Social Competence	
Autonomy The students are able to work in-term homework assignments. Due to the in-term feedback, they are enabled to self-assess their learning during the lecture period, already.	progress
during the recture period, arready.	
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 Environmental Engeneering: Compulsory	
Curricula General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
Civil- and Environmental Engineering: Core qualification: Compulsory	
General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory	
General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory	

Course L0673: 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	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	Krātzig, W. B.; Harte, R.; Meskouris, K.; Wittek, U.: Tragwerke 2 - Theorie und Berechnungsmethoden statisch unbestimmter Stabtragwerke, 4. Auflage, Berlin, 2004



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



Module M0611: Steel Struct	turos I			
Module Moor r. Steel Struct	luico i			
Courses				
Title		Тур	Hrs/wk	СР
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	Chrystyral analysis I Structural analysis II			
Knowledge	Structural analysis I, Structural analysis II Mechanics I, Mechanics II			
	,			
	Building Materials and Building Chemistry Britain Lead Building Materials and Building Bhusing			
	 Principles of Building Materials and Building Physics 			
Educational Objectives	After taking part successfully, students have reached the following	owing 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 tens	sion, compression and bending		
Skills	Students can rate and apply the material steel appropriately v	vith respect to its properties and usage.		
	They can use the security concept with respect to loads, force	es and resistances.		
	They can check the ultimate limit state and the serviceability	of simple members in tension, compression an	d bending.	
Personal Competence				
Social Competence	After participation of an optional course (building of a simple	e truss) they are able to organize themselves	in groups. They will	be successful in guided
	building a truss with bolted connections according to design	drawings.		
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Civil- and Enviromental Engeneering: Cor	mpulsory	
Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsor	у	
	Civil- and Environmental Engineering: Core qualification: Co	mpulsory		
	General Engineering Science (English program): Specialisa	tion Civil- and Enviromental Engeneering: Com	npulsory	
	General Engineering Science (English program, 7 semester)	: Specialisation Civil Engineering: Compulsory	/	

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	Dr. Jürgen Priebe, Prof. Uwe Starossek
Language	DE
Cycle	WiSe
Content	Introduction to steel constructions Materials Design and security model Tension rods Beams (elsatic and plastic design Column design Bolted connections
Literature	Petersen, C.: Stahlbau, 4. Auflage 2013, Springer-Vieweg Verlag Wagenknecht, G.: Stahlbau-Praxis nach Eurocode 3, Bauwerk-Verlag 2011 Band 1 Tragwerksplanung, Grundlagen Band 2 Verbindungen und Konstruktionen



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



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

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



Course L0956: Hydrology	
Тур	Problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

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



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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

Process Engineering: Core qualification: Compulsory

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



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



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

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

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



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



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

Technomathematics: Specialisation II. Informatics: Elective Compulsory



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

Course L0321: Computer Engineeri	ng
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	Introduction Combinational Logic Sequential Logic Fechnological 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 Engineerii	ng
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	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 shifte
- 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
- 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 M0631: Concrete S	tructures II			
Courses				
Title		Тур	Hrs/wk	CP
Project Concrete Structures II (L0894)		Project Seminar	1	1
Concrete Structures II (L0348)		Lecture	3	4
Concrete Structures II (L0349)		Recitation Section (large)	1	1
Module Responsible	Prof. Günter Rombach			
Admission Requirements	none			
Recommended Previous	Knowledge of loads on structures and combination of acti-	one		
Knowledge	Basics of safety format are required.	UIIS		
	Knowledge in design of beams and columns for ultimate I	imit stata		
	Lecture 'Concrete Structures I'	iiiit state		
	Lecture Concrete Structures 1			
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	g		
Knowledge	The students know the basic principles which arev required for d	lesion of reinforced concrete structures. T	nev know the various	methods to estimate the
rinowicage	member forces in simple one and two-way slabs.	iosign or remorece concrete structures. T	ncy know the various	methods to estimate the
Skills	member lordes in simple one and two-way slabs.			
Skills	The students can design reinforced concrete structure in t	he ultimate limit state (shear, bending, tor	sion) and in the servi	ceability limit state (crack
	and deflection control) including detailing (anchorage and	l links etc.).		
	The students can estimate the member forces of simple sl.	abs.		
	The students know the content and the layout of a structure	al analysis		
Personal Competence				
Social Competence	Cooperation in a project work, where they design in a team a rea	concrete building and present the results	at the end.	
Autonomy				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation	Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semester): Sp	ecialisation Civil Engineering: Elective Co	mpulsory	
	Civil- and Environmental Engineering: Core qualification: Compu	Isory		
	General Engineering Science (English program): Specialisation (Civil- and Enviromental Engeneering: Cor	npulsory	
	General Engineering Science (English program, 7 semester): Spo	ecialisation Civil Engineering: Elective Co	mpulsory	

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

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



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

Course L0552: Foundation Engineer	ing
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	 Shallow foundations Pile foundations Ground improvement 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



Courses				
Title		Тур	Hrs/wk	CP
Applied Numerical Methods (L0211)		Seminar	3	3
Applied Structural Dynamics (L0791)		Lecture	2	2
AutoCAD (L1211)		Recitation Section (small)	2	3
Computational Analysis of Structures (L03	70)	Lecture	1	3
Computational Analysis of Structures (L03	72)	Recitation Section (large)	1	1
Introduction in Statitics with R (L0286)		Lecture	1	1
Introduction in Statitics with R (L0776)		Recitation Section (large)	1	1
Principles of Geomatics (L0470)		Lecture	2	2
Principles of Geomatics (L0471)		Recitation Section (small)	2	2
Numeric and Matlab (L0125)		Laboratory Course	2	2
Practical Course in Drinking Water Chemic	stry (L1744)	Laboratory Course	1	2
Projects II (L1228)		Project Seminar	2	2
Fire Protection and Prevention (L0472)		Lecture	2	2
Module Responsible	Prof. Wilfried Schneider			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge	The students are at home doing with typical applications of the study programme.			
01.111				
Skills			n the learnt methods ii	
	new forms of application independently".			
Paraenal Competence				
Personal Competence				
Social Competence		to perform tasks or to conduct a project in teams. If so, the	iey can present, disci	uss and document resu
	accordingly.			
Ata = = ====	A		l	
Autonomy	According to the course chosen individual students	s can plan and document tasks and work flow for themse	ives or for the team.	
Workload in Hours	Depends on choice of courses			
Credit points	6			
Assignment for the Following	General Engineering Science (German program, 7	semester): Specialisation Civil Engineering: Elective Co	ompulsory	
Curricula	Civil- and Environmental Engineering: Core qualifie	cation: Compulsory		



	lethods
Тур	Seminar
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	4 schriftliche Ausarbeitungen und erfolgreiche Bearbeitung von semesterbegleitenden Vips
Lecturer	Dr. Gernod Deckelmann
Language	DE Use
Cycle	WiSe
Content	Possible methods to solve engineering problems
	Application of numerical methods
	Basic steps in the finite element method
	Requests for the geometric modell
	Linear, quadratic and cubic elements
	Minimum total potential energy formulation and verification of results
	Non-linear problems and error-estimation procedures
	Application of ANSYS to solve typical problems in the fields of civil engineering
	The state of the s
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung
	Müller, Günter (Groth, Clemens)
	FEM für Praktiker
	ISBN: 3816926851 (Kt.) ISBN: 978-3-8169-2685-6
	Renningen: expert-Verl, 2007
	Groth, Clemens (Müller, Günter)
	FEM für Praktiker
	ISBN: 3816918581
	Renningen: Expert-Verl, 2001
	Chandrupatla, Tirupathi R (Belegundu, Ashok D.; Ramesh, T.)
	Introduction to finite elements in engineering
	ISBN: 0132162741 (United States ed.) ISBN: 9780132162746 (United States ed.) ISBN: 0273763687 (International ed.) ISBN: 9780273763
	(International ed.)
	Upper Saddle River, NJ [u.a.] Prentice Hall, 2012 Gvk
	Manuari Connel
	Moaveni, Saeed
	Finite element analysis : theory and application with ANSYS
	ISBN: 0132416514 ISBN: 9780132416511
	Upper Saddle River, NJ Pearson Prentice-Hall, 2008 Gvk
	Patankar, Suhas V
	Numerical heat transfer and fluid flow
	ISBN: 0891165223
	New York [u.a.] : Hemisphere Publ. Co, 1980
	Bathe, Klaus-Jürgen (Zimmermann, Peter)
	Finite-Elemente-Methoden
	ISBN: 3540668063 (Gb.) ISBN: 978-3-540-66806-0



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

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



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

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



Course I 000C Introduction in Ctatis	as with D
Course L0286: Introduction in Statiti	
Тур	Lecture
Hrs/wk	1
CP	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	60 min
Lecturer	Dr. Joachim Behrendt
Language	DE NEO
Cycle	WiSe
Content	Introduction to R
	Graphics with R
	Descriptive Statistic (Boxplot, Percentiles, outliers)
	Propability (Combinatorics, relative frequency, dependand probability)
	random numbers and distibutions (confidence interval, uniform and discrete distributions, test-distributions (t-F-X²-distribution))
	Correlation and Regression analysis (Confidence interval of calibration curves, linearity)
	Statistic test procedures (mean value-t-Test, Chi^2-Test, F-Test)
	Analysis of variance (ANOVA, Bartlett-Test, Kruskal-Wallis Rank sum test)
	Introduction time series (tseries)
	Introduction cluster analysis (k-means)
Literature	Regionales Rechenzentrum für Niedersachsen
	Statistik mit R
	Grundlagen der Datenanalyse
	,2013
	Einführung in die Statistik mit R, Andreas Handl, Skript Uni Bielefeld
	http://www.wiwi.uni-bielefeld.de/fileadmin/emeriti/frohn/handl_grundausbildung/statskript.pdf
	und die dazugehörige Aufgabensammlung http://www.wiwi.uni-bielefeld.de/fileadmin/emeriti/frohn/handl_grundausbildung/statauf.pdf
	The state of the s
	Induktive Statistik [Elektronische Ressource] : eine Einführung mit R und SPSS / Helge
	von Toutenburg, Helge 2008
	http://dx.doi.org/10.1007/978-3-540-77510-2http://dx.doi.org/10.1007/978-3-540-77510-2
	R-Referenzcard: http://cran.r-project.org/doc/contrib/Short-refcard.pdfhttp://cran.r-project.org/doc/contrib/Short-refcard.pdf
	Grafiken und Statistik in R von Andreas Plank
	$Nach schlage Skript mit Beispielen: http://www.geo.fu-berlin.de/geol/fachrichtungen/pal/mitarbeiter/plank/Formeln_in_R.pdfhttp://www.geo.fu-berlin.de/geol/fachrichtungen/pal/mitarbeiter/plank/Formeln_in_R.pdf www.geo.fu-berlin.de/geol/fachrichtungen/pal/mitarbeiter/plank/Formeln_in_R.pdf www.geo.fu-berlin.de/geol/fachrichtungen/pal/mitarbeiter/plank/Formeln_in_R$

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



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

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



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

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

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



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



ırses	ns of Management			
)		Тур	Hrs/wk	СР
duction to Management (L0880)		Lecture	3	3
ect Entrepreneurship (L0882)		Problem-based Learning	2	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ng learning results		
Professional Competence				
Knowledge	After taking this module, students know the important basics o Marketing and Innovation, and also to Investment and Controlli		nagement, from Plani	ning and Organisation
	explain the differences between Economics and Manag field of Management	ement and the sub-disciplines in Managem	ent and to name impo	ortant definitions from
	explain the most important aspects of and goals in Management	agement and name the most important aspe	cts of entreproeurial r	orniects
	describe and explain basic business functions as proc			
	ressource management, information management, inno		, ·	
	explain the relevance of planning and decision making	•	Itiple objectives and	uncertainty, and expl
	some basic methods from mathematical Finance	, ,		,
	state basics from accounting and costing and selected of	controlling methods.		
Skills	Students are able to analyse business units with respective Entrepreneurship project in a team. In particular, they are able to		tives, strategies etc	.) and to carry out
	Emagnetication project in a team. In particular, and also to			
	analyse Management goals and structure them appropr	iately		
	analyse organisational and staff structures of companies	S		
	apply methods for decision making under multiple objection.			
	analyse production and procurement systems and Busin	ness information systems		
	analyse and apply basic methods of marketing			
	select and apply basic methods from mathematical finar select and apply basic methods from mathematical finar			
	 apply basic methods from accounting, costing and contr 	olling to predefined problems		
Personal Competence				
Social Competence	Students are able to			
	and a second the least of the death			
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepress	neursnip project and write a conerent report	on the project	
	 to communicate appropriately and to cooperate respectfully with their fellow students. 			
	to cooperate respectionly with their lenow students.			
Autonomy	Students are able to			
	work in a team and to arganize the team themselves.			
	 work in a team and to organize the team themselves to write a report on their project. 			
	to write a report of their project.			
We alst a at last the con-	Independent Study Time 110, Study Time in Lecture 70			
Workload in Hours	6			
Credit points				
Credit points	Written exam			
Credit points Examination	Written exam 90 Minuten	n Electrical Engineering: Compulsory		
Credit points Examination Examination duration and scale	Written exam 90 Minuten General Engineering Science (German program): Specialisatio	0 0 1 ,		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio	n Computer Science: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio	n Computer Science: Compulsory n Process Engineering: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory	ompulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Co		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Co n Civil- and Enviromental Engeneering: Co		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Co n Civil- and Enviromental Engeneering: Co n Mechanical Engineering: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Co n Civil- and Enviromental Engeneering: Co n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Co n Civil- and Enviromental Engeneering: Co n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory	mpulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory Specialisation Electrical Engineering: Comp	ulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): S	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory Specialisation Electrical Engineering: Comp	ulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio 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 Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory Specialisation Electrical Engineering: Compu	ulsory ulsory lsory npulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): Science (German program): Science (German pr	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Co n Civil- and Enviromental Engeneering: Co n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory Specialisation Electrical Engineering: Compulsory Specialisation Process Engineering: Compulsory Specialisation Biomedical Engineering: Compulsory Specialisation Naval Architecture: Compulsory	ulsory ulsory lsory npulsory nry	
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): General Engineering Science (German program)	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Cor n Civil- and Enviromental Engeneering: Cor n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory Specialisation Electrical Engineering: Compulsory Especialisation Process Engineering: Compulsory Specialisation Biomedical Engineering: Compulsory Especialisation Naval Architecture: Compulsory Especialisation Computer Science: Compulsory Especialisation Dioprocess Engineering: Compulsory Especialisation Bioprocess Engineering: Compulsory	ulsory lsory npulsory ory npulsory ory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisatio General Engineering Science (German program, Specialisatio General Engineering Science (German program, 7 semester): General Engineering Science (n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Cor n Civil- and Enviromental Engeneering: Cor n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory Specialisation Electrical Engineering: Compulsory Specialisation Process Engineering: Compulsory Specialisation Biomedical Engineering: Compulsory Specialisation Naval Architecture: Compulsory Specialisation Dioprocess Engineering: Compulsory Specialisation Computer Science: Compulsory Specialisation Bioprocess Engineering: Compulsory	ulsory lsory pulsory pry pry pry pulsory	у
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Specialisation General Engineering Science (German	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Cor n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory Specialisation Electrical Engineering: Compulsory Specialisation Process Engineering: Compulsory Especialisation Naval Architecture: Compulsor Specialisation Biomedical Engineering: Compulsor Specialisation Dioprocess Engineering: Compulsor Specialisation Bioprocess Engineering: Compulsor Specialisation Civil Engineering: Compulsor Specialisation Energy and Enviromental Engispecialisation Mechanical Engineering, Foc	ulsory lsory pulsory pry pry pulsory y gineering: Compulsor us Mechatronics: Cor	mpulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Specialisation General Engineering Science (German	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory Specialisation Electrical Engineering: Compulsory Specialisation Process Engineering: Compulsory Specialisation Naval Architecture: Compulsor Specialisation Diomedical Engineering: Compulsor Specialisation Diomedical Engineering: Compulsor Specialisation Computer Science: Compulsor Specialisation Eioprocess Engineering: Com Specialisation Engineering: Compulsor Specialisation Mechanical Engineering, Foc Specialisation Mechanical Engineering, Foc	ulsory Isory Isory Ipulsory Iry Ipulsory Ipulsor	mpulsory mpulsory
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Specialisation General Engineering Science (German	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory Specialisation Electrical Engineering: Compulsory Specialisation Process Engineering: Compulsory Specialisation Naval Architecture: Compulsor Specialisation Diomedical Engineering: Compulsor Specialisation Diomedical Engineering: Compulsor Specialisation Computer Science: Compulsor Specialisation Eioprocess Engineering: Com Specialisation Engineering: Compulsor Specialisation Mechanical Engineering, Foc Specialisation Mechanical Engineering, Foc Specialisation Mechanical Engineering, Foc Specialisation Mechanical Engineering, Foc	ulsory Isory Isory Ipulsory Iry Inpulsory Inpulsory Inpulsory Inpulsory Inpulsory Isory Is	mpulsory mpulsory ngineering: Compulso



Compulsory

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

mpulsory

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

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

Energy and Environmental Engineering: Core qualification: Compulsory

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

 $\label{thm:condition} \textbf{General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory and the second seco$

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

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

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

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

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

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

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

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

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

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

defieral Engineering Science (English program, 7 semester). Specialisation biomedical Engineering. Comput

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 Bioprocess Engineering: Compulsory

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

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

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

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

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Тур	Lecture		
Hrs/wk	3		
CP	3		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42		
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgr		
Lecturer	roi. Omisioph ini, Proi. Thorsien Biecker, Proi. Omisian Luinje, Proi. Omisian Ringle, Proi. Rainnn Fischer, Proi. Comeilus Hersiali, Proi. Wollgar 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 		
Literature	 Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008 Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003 Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006. Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001. Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008. Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005. Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008. Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006. 		

Course L0882: Project 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	
Language	DE	
Cycle	WiSe/SoSe	
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept, using their knowledge from the corresponding lecture. Project work is carried out in teams with the support of a mentor.	
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.	



Module M0579: Structural I)esign					
Courses						
itle		Тур	Hrs/wk	СР		
asics of Structural Design (L0205)		Lecture	2	1		
eminar in Structural Design (L0209)		Seminar	2	4		
eminar in Structural Design (L0208)		Recitation Section (large)	1	1		
Module Responsible	Dr. Gernod Deckelmann					
Admission Requirements	none					
Recommended Previous	Contents of module "Principles of Building Materials at	nd Building Physics"				
Knowledge						
Educational Objectives	After taking part successfully, students have reached the	ne following learning results				
Professional Competence						
Knowledge	After attending the course students are able					
	to define the basics of building regulations law					
	 to specify typical building components 					
	 to distinguish different possibilities of load bear 	ing behaviour and risks due to lack of stability				
	to explain the main objectivs of fire control					
Skills	After attending the course students are able					
	• to evaluate development plans and to convert the main objectivs of building regulation laws to a architect's plan					
	to decide which building components should be	to decide which building components should be used to get a sufficient building stability				
	to proof the moisture behaviour, the energy consumption, the acoustic protection and the fire control of a construction					
	 to plot the results of drafts and decisions 					
Personal Competence						
Social Competence	After attending the course students are able					
oodal oompelence	Alter alterioring the course students are able					
	 to work in a team and to persent the results of the 	ne team work				
	 to use the feedback from other students to impr 	ove the own results				
	to give a feedback to other students in a constru	uctive manner				
Autonomy	After attending the course students are able					
	to control and improve their knowledge with the	help of weeekly presentations (lecture room) and to	ests (STUD.IP)			
		uce the needed knowledge and to schedule the diffe				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70)				
Credit points	6					
Examination	Written exam					
Examination duration and scale	60 minütige Klausur (max. 40 Punkte); semesterbeglei	tende Projektarbeit (max. 60 Punkte); Klausur minde	estens mit 4,0			
Assignment for the Following	General Engineering Science (German program, 7 ser					
Curricula	Civil- and Environmental Engineering: Core qualification		-			
	General Engineering Science (English program, 7 sen		0/			



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



_	I Design
Тур	Seminar
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Dr. Gernod Deckelmann
Language	DE
Cycle	SoSe
-	
Content	Constructing a small individuell building in groups of 4 persons
	 Analysing the informations and the contents of development plans and building regulation laws
	 Design of building components and approving of the funcionality (sealing, facades, roofs)
	Design and approve of the funcionality of the component interconnections
	 Proofing and assessing of moisture behaviour, energy comsumption, acoustic protection and fire control
	Assessing the building stabilty
	Basics of building services
	Each week the results of different work steps are presented in oral and written form
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung
	Neumann, Dietrich (Hestermann, Ulf.; Rongen, Ludwig.; Weinbrenner, Ulrich)
	Frick/Knöll Baukonstructionslehre 1 / [Internet-Ressource]
	ISBN: 978-3-8351-9121-1
	Wiesbaden : B.G. Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2006
	Frick[Begr.], Otto (Knöll[Begr.], Karl.; Neumann, Dietrich.; Hestermann, Ulf.; Rongen, Ludwig.)
	Baukonstruktionslehre 2 / [Internet-Ressource]
	ISBN: 978-3-8348-9486-1
	Wiesbaden : Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008
	Dierks, Klaus (Wormuth, Rüdiger.)
	Baukonstruktion: [Einführung, Grundlagen, Gründungen, technische Ausrüstung, Wände, Geschossdecken, Treppen, Dächer, Fenster, Ti
	Konstruktionsatlas]
	ISBN: 3804150454 (Gb.) ISBN: 978-3-8041-5045-4
	Neuwied : Werner, 2007
	Neuwied . Welliel , 2007
	Sahnaidar Klaus, lürnan (Coris Alfons : Bornar Klaus)
	Schneider, Klaus-Jürgen (Goris, Alfons.; Berner, Klaus) Rautabellen, für Ingenieure, i mit Regelhaungshinweisen, und Reispielen i fauf CD ROM: Stabwerkenragramm IO 100 R. Tools für den kr
	Bautabellen für Ingenieure : mit Berechnungshinweisen und Beispielen ; [auf CD-ROM: Stabwerksprogramm IQ 100 B, Tools für den ko
	Ingenieurbau, Fachinformationen, Normentexte]
	ISBN: 3804152287
	Neuwied : Werner, 2006
	Wandaharat Bainhard (Matrall Otto W. Daymanton Hamin Daytaka I 1971 (** November 1971)
	Wendehorst, Reinhard (Wetzell, Otto W.,; Baumgartner, Herwig,; Deutsches Institut für Normung)
	Wendehorst Bautechnische Zahlentafeln
	ISBN: 978-3-8351-0055-8 ISBN: 3835100556
	Stuttgart [u.a.]: Teubner Berlin [u.a.]: Beuth, 2007
	Neufert, Ernst (Kister, Johannes)
	Bauentwurfslehre : Grundlagen, Normen, Vorschriften über Anlage, Bau, Gestaltung, Raumbedarf, Raumbeziehungen, Maße für Gebäude, Rä
	Einrichtungen, Geräte mit dem Menschen als Maß und Ziel ; Handbuch für den Baufachmann, Bauherrn, Lehrenden und Lernenden



Hrs/wk 1			
	Recitation Section (large)		
00.1			
CP 1	_		
Workload in Hours In	ndependent Study Time 16, Study Time in Lecture 14		
Lecturer D	Dr. Gernod Deckelmann		
Language D	DE		
Cycle S	5oSe		
Content			
	Constructing a small individuell buildling in groups of 4 persons		
	 Analysing the informations and the contents of development plans and building regulation laws 		
	 Design of building components and approving of the funcionality (sealing, facades, roofs) 		
	Design and approve of the funcionality of the component interconnections		
	 Proofing and assessing of moisture behaviour, energy comsumption, acoustic protection and fire control 		
	Assessing the building stabilty		
	Basics of building services		
	Each week the results of different work steps are presented in oral and written form		
Literature V	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung		
N	Neumann, Dietrich (Hestermann, Ulf.; Rongen, Ludwig.; Weinbrenner, Ulrich)		
	Frick/Knöll Baukonstructionslehre 1 / [Internet-Ressource]		
IS	SBN: 978-3-8351-9121-1		
v	Wiesbaden : B.G. Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2006		
F	Frick[Begr.], Otto (Knöll[Begr.], Karl.; Neumann, Dietrich.; Hestermann, Ulf.; Rongen, Ludwig.)		
В	Baukonstruktionslehre 2 / [Internet-Ressource]		
IS	SBN: 978-3-8348-9486-1		
V	Wiesbaden : Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008		
D	Dierks, Klaus (Wormuth, Rüdiger.)		
В	Baukonstruktion : [Einführung, Grundlagen, Gründungen, technische Ausrüstung, Wände, Geschossdecken, Treppen, Dächer, Fenster, Tü		
К	Konstruktionsatlas]		
IS	SBN: 3804150454 (Gb.) ISBN: 978-3-8041-5045-4		
N	Neuwied: Werner, 2007		
s	Schneider, Klaus-Jürgen (Goris, Alfons.; Berner, Klaus)		
	Bautabellen für Ingenieure : mit Berechnungshinweisen und Beispielen ; [auf CD-ROM: Stabwerksprogramm IQ 100 B, Tools für den ko		
	ngenieurbau, Fachinformationen, Normentexte]		
	SBN: 3804152287		
	Neuwied : Werner, 2006		
l _v	Wendehorst, Reinhard (Wetzell, Otto W.: Baumgartner, Henvig : Deutsches Institut für Normung)		
ISBN: 978-3-8351-0055-8 ISBN: 3835100556 Stuttgart [u.a.] : Teubner Berlin [u.a.] : Beuth, 2007			
S	Naufert Frest (Kister Johannes)		
N	saueroworsieure, Googlagen Normen vorschrijen ober enjage Bau Gestalfung Baumpegart Baumpezienungen Make für Gehäude Bai		
N B E	Einrichtungen, Geräte mit dem Menschen als Maß und Ziel ; Handbuch für den Baufachmann, Bauherrn, Lehrenden und Lernenden		
N B E			
B Ir IS N W V IS	Bautabellen für Ingenieure : mit Berechnungshinweisen und Beispielen ; [auf CD-ROM: Stabwerksprogramm IQ 100 B, Tools für de ngenieurbau, Fachinformationen, Normentexte] SBN: 3804152287 Neuwied : Werner, 2006 Wendehorst, Reinhard (Wetzell, Otto W; Baumgartner, Herwig,; Deutsches Institut für Normung) Wendehorst Bautechnische Zahlentafeln SBN: 978-3-8351-0055-8 ISBN: 3835100556		



Module M0686: Sanitary Er	gineering				
Courses					
Title		Тур	Hrs/wk	СР	
Wastewater Disposal (L0276)		Lecture	2	2	
Wastewater Disposal (L0278)		Recitation Section (large)	1	1	
Drinking Water Supply (L0306) Lecture 2 1			1		
Drinking Water Supply (L0308)	Recitation Section (large) 1 2				
Module Responsible	Prof. Ralf Otterpohl				
Admission Requirements	none				
Recommended Previous	Book knowledge on Chamistry and Biology				
Knowledge	Basic knowledge on Chemistry and Biology Hydraulics of pipe systems and open channels				
	Basic knowledge on water management: water quantity and water	quality			
	Basic knowledge on water management, water quantity and water Basic knowledge on Environmental Legislation: Federal Water Act				
	Basic knowledge on Environmental Legislation. Federal Water Act				
Educational Objectives	After taking part successfully, students have reached the following learning	g results			
Professional Competence					
Knowledge	The students can examplify their expert knowledge on urban water infrast	ructures. They can present the derivati	on and detailed	explanation of important	
	standards for the design of drinking water supply and wastewater disp	osal systems in Germany and they a	re capable of r	eproducing the relevant	
	empiricals assumptions and scientific simplifcations. The students are abl	e to present and discuss sanitary engi	neering process	ses and the technologies	
	used for drinking and wastewater treatment. They can also assess existing	ng problems in the field of sanitary en	gineering by co	nsidering legal, risk and	
	saftey aspects. Furthermore, they know how to draft the features and e	ffectiveness of important technologic	es of the future	such as high- and low-	
	pressure membrane filtration systems and techniques for the removal of tra	ace pollutants.			
Skills	The students are able to apply the relevant standards and guidelines for expertise comprises expert skills to design drinking water supply and urb acquirement of technical skills the students are able to address and solve. The students are also able to develop ideas of their own to improve the ex	an drainage systems as well as the as biochemical problems in the filed of c	sociated treatme Irinking water ar	ent facilities. Besides the nd wastewater treatment.	
Personal Competence Social Competence	Students are able to form concepts on their own to optimize urban wate when being given some clues or information with regard to the approach t	•			
Autonomy					
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84				
Credit points	6				
Examination duration and scale	Written exam				
Examination duration and scale	120 min	1 Environmental Engancering Community	·on/		
Assignment for the Following	General Engineering Science (German program): Specialisation Civil- and				
Curricula	General Engineering Science (German program, 7 semester): Specialisati	on Givii Engineering: Elective Compul	sury		
	Civil- and Environmental Engineering: Core qualification: Compulsory	Environmental Engagemental Communication	25.4		
	General Engineering Science (English program): Specialisation Civil- and		-		
	General Engineering Science (English program, 7 semester): Specialisation	on Givii Engineering: Elective Compul	sory		



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

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



Course L0306: Drinking Water 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



Module M0869: Hydraulic E	ingineering II			
Wodale Woods. Hydraulic L				
Courses				
Title		Тур	Hrs/wk	СР
Hydraulics (L0957)		Lecture	1	1
Hydraulics (L0958)		Recitation Section (large)	1	1
Hydraulic Engineering (L0959)		Lecture	2	2
Hydraulic Engineering (L0960)		Recitation Section (large)	1	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	none			
Recommended Previous	Hydraulik Engineering I			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results		
Professional Competence				
Knowledge	Students are able to define the basic terms of hydraulic engi	neering and hydraulics. They are able to	explain the applicatio	n of basic hydrodynamic
	formulations (conservation laws) to practical hydraulic engir	neering problems. Besides this, the studer	nts can illustrate imp	ortant tasks of hydraulic
	engineering and give an overview over river engineering, floor	d protection, hydraulic power engineering ar	nd waterways engine	ering.
Skills	The students are able to apply hydraulic engineering methods			
	systems. Besides this, they are able to use and apply establish	• • • • • • • • • • • • • • • • • • • •	e water surfaces of ch	annel flows, influences of
	constructions (weirs, etc.) on channel flows as well as flow con	ditions of pipe system.		
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	The duration of the examination is 2 hours. The examinatio	n includes tasks with respect to the gener	ral understanding of	the lecture contents and
	calculations tasks.			
Assignment for the Following	General Engineering Science (German program): Specialisation	on Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semester):	Specialisation Civil Engineering: Elective C	ompulsory	
	Civil- and Environmental Engineering: Core qualification: Com	pulsory		
	General Engineering Science (English program): Specialisatio	n Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (English program, 7 semester):			
			. ,	

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



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

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



Specialization Bioprocess Engineering

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

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

Courses			
ïtle		Тур	Hrs/wk CP
Introduction into Process Engineering/Bioprocess Engineering (L0829)		Lecture	2 1
undamentals of material engineering (L08	330)	Lecture	2 2
Module Responsible	Prof. Michael Schlüter		
Admission Requirements	none		
Recommended Previous	none		
Knowledge			
Educational Objectives	After taking part successfully, students have reach	ned the following learning results	
Professional Competence			
Knowledge	After passing this module the students have the al	bility to:	
	give an overview of the most important field	ds on process and bioprocess engineering	
	explain some working methods for different		
		g.	
Skills	After passing this module the students should have	re the ability to:	
	list and outline the most important fields of	process engineering,	
		hes or methods of the different fields of process eng	ineering,
	read and prepare an engineering drawing		3,
	explain the most important technologies for		
		gical processes independently with the aid of pointer	rs.
Personal Competence			
Social Competence	The students are able to		
	 work out results in groups and document tl 	hem,	
		feedback on their own performance constructively.	
		,	
Autonomy		s of learning by themselves and to deliberate the	ir lack of knowledge in Process Enginee
	Bioprocess Engineering.		
Workload in Hours	Independent Study Time 34, Study Time in Lecture	e 56	
Credit points	3		
Examination	Written exam		
Examination duration and scale	90 min		
Assignment for the Following	General Engineering Science (German program):	Specialisation Process Engineering: Compulsory	
Curricula		Specialisation Bioprocess Engineering: Compulsor	ry
		7 semester): Specialisation Process Engineering: C	
		7 semester): Specialisation Bioprocess Engineering	
	Bioprocess Engineering: Core qualification: Comp	, , , , , , , , , , , , , , , , , , , ,	-
		Specialisation Bioprocess Engineering: Compulsory	у
	General Engineering Science (English program):		-
		7 semester): Specialisation Process Engineering: Co	ompulsory
		7 semester): Specialisation Bioprocess Engineering:	
	Process Engineering: Core qualification: Compuls		



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

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



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

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



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



_	Engineering		
Courses			
Title	Тур	Hrs/wk	СР
Computer Engineering (L0321)	Lecture	3	4
Computer Engineering (L0324)	Recitation Section (small)	1	2
Module Responsible	Prof. Heiko Falk		
Admission Requirements Recommended Previous	None Basic knowledge in electrical engineering		
Knowledge	basic knowledge in electrical engineering		
	The successful completion of the labs will be honored during the evaluation of the module's examination acc	cording to the followi	ng rules:
	1. Upon a passed module examination, the student is granted a bonus on the examination's mark	ks due to the succe	ssful labs, such that the
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	This module deals with the foundations of the functionality of computing systems. It covers the layers fro	m the assembly-leve	el programming down
	gates. The module includes the following topics:		
	Introduction		
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational	I networks	
	Sequential logic: Flip-flops, automata, systematic hardware design		
	Technological foundations		
	Computer arithmetic: Integer addition, subtraction, multiplication and division		
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining		
	 Memories: Memory hierarchies, SRAM, DRAM, caches Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connection 	as bussas	
	• impuloutput, i/O from the perspective of the OFO, principles of passing data, point-to-point connection	ns, busses	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal	I structure and the	physical composition
	computer systems. The students can analyze, how highly specific and individual computers can be bu		
	components. They are able to distinguish between and to explain the different abstraction layers of today's	computing systems	- from gates and circu
	up to complete processors.		
	After successful completion of the module, the students are able to judge the interdependencies between a	a physical computer	system and the softwa
	executed on it. In particular, they shall understand the consequences that the execution of software has on	the hardware-centri	c abstraction layers fro
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low	abstraction levels ha	ave on an entire systen
	performance and to propose feasible options.		
Personal Competence			
Social Competence	Students are able to solve similar problems alone or in a group and to present the results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other	her classes.	
	Independent Study Time 124, Study Time in Lecture 56		
Credit points			
Examination	Written exam		
Examination duration and scale	90 minutes, contents of course and labs		
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory		
Assignment for the Following	Constal Facine with Colored (Constant Vaccount V		
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsor	-	
-	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Com	pulsory	
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-	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Comp General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsor	pulsory ry	
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Technomathematics: Specialisation II. Informatics: Elective Compulsory



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

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

Course L0324: Computer Engineerii	ng
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	
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
	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 shifte
- 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
- 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 M0536: Fundament	als of Fluid Mechanics			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Fluid Mechanics (L0091) Fluid Mechanics for Process Engineering	(1,0002)	Lecture Recitation Section (large)	2	4
	Prof. Michael Schlüter	riecitation Section (large)	2	2
Module Responsible				
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 learn	ing recults		
	After taking part successionly, students have reached the following ream	ing results		
Professional Competence	Childonta are able to:			
Knowledge	Students are able to:			
	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-Equations 	ation by using physical boundary	conditions	
Skille	The students are able to			
Skills	The students are able to			
	 describe and model incompressible flows mathematically 			
	 reduce the governing equations of fluid mechanics by simplificat 	ions to archive quantitative solution	ons e.g. by integration	
	 notice the dependency between theory and technical application 	IS		
	 use the learned basics for fluid dynamical applications in fields of 	f process engineering		
Personal Competence				
Social Competence	The students			
Coolai Competence	The stateme			
	 are capable to gather information from subject related, profession 	nal publications and relate that in	formation to the context	of the lecture and
	 able to work together on subject related tasks in small groups. T 	ney 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 pr	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 Process General Engineering Science (German program): Specialisation Biopro			
Gurricula	General Engineering Science (German program): Specialisation Energy		Compulsorv	
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specialis		•	
	General Engineering Science (German program, 7 semester): Specialis			у
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Bioprod	ess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Energy	and Environmental Engineering: 0	Compulsory	
	General Engineering Science (English program): Specialisation Proces	s Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisa	ation Process Engineering: Comp	ulsory	
	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 C	ompulsory		
	Process Engineering: Core qualification: Compulsory			



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

Course L0092: Fluid Mechanics for F	Process Engineering
Тур	Recitation Section (large)
Hrs/wk	2
СР	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-
Literature	frame in small groups and discuss the solutions afterwards.
	 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 M0544: Phase Equ	ilibria Thermodynamics			
Courses				
		Turn	Hrobuk	CD
Title Thermodynamics III (I 0114)		Typ Lecture	Hrs/wk	CP 2
Thermodynamics III (L0114) 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 II			
Knowledge	maticinates, i hysical orientisty, memodynamics rand ii			
····ougo				
Educational Objectives	After taking part successfully, students have reached the followin	a learning results		
Professional Competence	The taking part successionly, state its nave reastred the following	g rearring results		
Knowledge				
Knowledge	 Starting from the very basics of thermodynamics, the students 	ents learn the mathematical tools to desc	ribe thermodynamic e	quilibria.
	They learn how state variables are influenced by the mixing	ng of compounds and learn concepts to o	quantitatively describe	these properties.
	 Moreover, the students learn how phase equilibria can be 	e described mathematically and which pl	nenomena may occur	if different phases (vapor
	liquid, solid) coexist in equilibrium. Furthermore the funda	mentals of reaction equilibria are taught.		
	For different phase equilibria, several examples relevant	for different kinds of processes are show	n and the necessary k	nowledge for plotting and
	interpreting the equilibria are taught.			
Skills				
	 Applying their knowledge, the students are able to ident 	ify the correct equation for the determin	ation of the equilibriur	n state and know how to
	simplify these equations meaningfully.			
	The students know models which can be used to determ	nine the properties of the system in the e	equilibrium state and t	hey are able to solve the
	resulting mathematical relations.			
	For specific applications, they are able to self-reliantly fine	d necessary physico-chemical properties	of compounds as wel	Il as model parameters in
	literature sources.	to a finite and the other constant of actions		
	Beside pure compound properties the students are capable The students have been been discussed in the students are capable. The students have been discussed in the students are capable.			
	The students know how to visualize phase equilibria grap			
	Based on their knowledge, the students are able to ur	iderstand fundamental concepts that ar	e the basis for many	separation and reaction
	processes in chemical engineering.			
Personal Competence				
Social Competence	The students are able to work in small groups, to solve the corres	ponding problems and to present them o	oraly to the tutors and o	other students
Autonomy	 The students are able to find necessary information self-re 	eliantly in literature sources and to judge	their quality.	
	During the semester the students are able to check their	, , ,		wledge the students car
	adept their learning process.	3, 3		<u> </u>
	, , , , , , , , , , , , , , , , , , , ,			
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		
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program, 7 semester): Sp		ulsorv	
	General Engineering Science (German program, 7 semester): Sp.			
	Bioprocess Engineering: Core qualification: Compulsory	ocianisation bioprocess Engineering: Of	тризоту	
		Rionrocess Engineering: Compulsor-		
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation		deen	
	General Engineering Science (English program, 7 semester): Sp			
	General Engineering Science (English program, 7 semester): Sp	eciansation bioprocess Engineering: Co	приготу	
	Process Engineering: Core qualification: Compulsory			



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

Course L0140: Thermodynamics III	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	SoSe
Content	1. Introduction: Applications of thermodynamics of mixtures 2. Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity 3. Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule 4. Equations of state: virial equations, van-der-Waals equation, generalized equations of state 5. Mixing properties: ideal and real mixtures, excess properties, partial molar properties 6. Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition 7. Gas-liquid-equilibria: equilibrium condition, Henry-coefficient 8. GE-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC 9. Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems 10. Solid-liquid-equilibria: equilibrium condition, binary systems 11. Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature 12. Osmotic pressure The students work on tasks in small groups and present their results in front of all students.
Literature	 Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997 J.P. O'Connell, J.M. Haile: Thermodynamics. Cambridge University Press, 2005.



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



ourses				
le		D. ros	Hrs/wk	CP
		Typ .ecture	7 nrs/wk	4
nals and Systems (L0432) nals and Systems (L0433)		Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch	(
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge	Water and the second se			
	The modul is an introduction to the theory of signals and systems. Good kni- Further experience with spectral transformations (Fourier series, Fourier transf			nematik 1-3 is expe
Educational Objectives	After taking part successfully, students have reached the following learning re-	sults		
Professional Competence				
Knowledge	The students are able to classify and describe signals and linear time-invaria	ant (LTI) systems using meth-	ods of signal and syste	em theory. They are
	to apply the fundamental transformations of continuous-time and discrete-time	signals and systems. They	can describe and anal	yse deterministic sig
	and systems mathematically in both time and image domain. In particular, t	they understand the effects	in time domain and ir	mage domain which
	caused by the transition of a continuous-time signal to a discrete-time signal.			
Skills	The students are able to describe and analyse deterministic signals and lines	ar time-invariant systems us	sing methods of signal	and system theory.
	can analyse and design basic systems regarding important properties such a	as magnitude and phase res	sponse, stability, linear	ity etc They can as
	the impact of LTI systems on the signal properties in time and frequency doma	ain.		
Personal Competence				
Social Competence	The students can jointly solve specific problems.			
Autonomy	The students are able to acquire relevant information from appropriate literal	ture sources. They can con	ntrol their level of know	ledge during the le
	period by solving tutorial problems, software tools, clicker system.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Electrical En	naineerina: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Computer (German program): Specialisation Computer (German program): Specialisation C			
Garricula	General Engineering Science (German program): Specialisation Process Eng			
	General Engineering Science (German program): Specialisation Process Eng			
	General Engineering Science (German program): Specialisation Civil- and En		omnulsory	
	General Engineering Science (German program): Specialisation Mechanical I		ompaisory	
	General Engineering Science (German program): Specialisation Mechanical Engineering Science (German program): Specialisation Biomedical E			
	General Engineering Science (German program, 7 semester): Specialisation I		nnulsorv	
	General Engineering Science (German program, 7 semester): Specialisation (
	General Engineering Science (German program, 7 semester): Specialisation I			
	General Engineering Science (German program, 7 semester): Specialisation I			
	General Engineering Science (German program, 7 semester): Specialisation I			
	General Engineering Science (German program, 7 semester): Specialisation I			mnulsory
	General Engineering Science (German program, 7 semester): Specialisation I			
	General Engineering Science (German program, 7 semester): Specialisation I			
	General Engineering Science (German program, 7 semester): Specialisation			
	Compulsory	Jon Mechanical Engineerin	ig, rocus iviateriais iri	Lingineering Scien
	• •	Mochanical Engineering Fo	ous Mochatronics: Cor	nnulcon/
	General Engineering Science (German program, 7 semester): Specialisation I			
	General Engineering Science (German program, 7 semester): Specialisation	on wechanical Engineering	y, rucus ineoretical N	nechanical Enginee
	Computer Science Core qualification Computers			
	Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory			
		viromental Engangering: 0-	omnuleor;	
	General Engineering Science (English program): Specialisation Civil- and Engeneral Engineering Science (English program): Specialisation Bioprocess E		πιμαιουιγ	
	General Engineering Science (English program): Specialisation Bioprocess E General Engineering Science (English program): Specialisation Electrical Eng			
	General Engineering Science (English program): Specialisation Electrical English Program): Specialisation Computer Science (English program): Specialisation Computer (English program): Specialisation Computer (,		
	General Engineering Science (English program): Specialisation Computer Science (English program): Specialisation Mechanical E			
	General Engineering Science (English program): Specialisation Mechanical E General Engineering Science (English program): Specialisation Biomedical E			
	General Engineering Science (English program): Specialisation Process Engi			
	General Engineering Science (English program): Specialisation Process Engineering Science (English program, 7 semester): Specialisation E		nulsory	
	General Engineering Science (English program, 7 semester): Specialisation E			
	General Engineering Science (English program, 7 semester): Specialisation F			
	General Engineering Science (English program, 7 semester): Specialisation E			
	General Engineering Science (English program, 7 semester): Specialisation E			
	General Engineering Science (English program, 7 semester): Specialisation M			npulsory
	General Engineering Science (English program, 7 semester). Specialisation N			
		-		
	General Engineering Science (English program, 7 semester): Specialisation N			
	General Engineering Science (English program, 7 semester): Specialisati	ion iviconamicai Engineerin	ig, i ocus ivialeriais In	Lugineening Sciel
	Compulsory General Engineering Science (English program 7 semester): Specialisation N	Machanical Engineering For	oue Machatronias: C	nuleon,
	General Engineering Science (English program, 7 semester): Specialisation N			
	General Engineering Science (English program, 7 semester): Specialisation	on wechanical Engineering	j, rocus ineoretical N	nechanicai Enginee
Į.				
	Compulsory Computational Science and Engineering: Core qualification: Compulsory			



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

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



Module M0757: Biochemist	try 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 the following learn	ning results		
Professional Competence				
Knowledge	At the end of this module the students can:			
	- explain the methods of biological and biochemical research to determ	nine 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 view in discussion	ns in teams		
	- to divide a complex task into subtasks, solve these and to present the	combined results		
Autonomy	The students are able to present the results of their subtasks in a written	n 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): Specialisation Biopro	ocess Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Specialis	sation Bioprocess Engineering: Cor	mpulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Biopro	cess Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Specialis	sation Bioprocess Engineering: Con	npulsory	
	Technomathematics: Specialisation III. Engineering Science: Elective C	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: 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	
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



Typ Lecture Hrs/wk 2 CP 2 Workload in Hours Independent Study Time 32, Study Time in Lecture 28 Lecturer Dr. Christian Schäfers Content 1 - Evolution - Evo	Course L0881: Microbiology	
Mrswk 2 Workload in Hours Independent Study Time 32, Study Time in Lecture 28 Lecturer Dr. Christian Schäfers Language DS SoSe Content 1. The procaryotic cell	Тур	Lecture
Norkload in Hours Independent Study Time 32, Study Time in Lecture 28	Hrs/wk	2
Lenguage DE Cycle SoSe Content 1. The procaryotic cell • evolution • taxonomy and specific properties of Archaea, Bacteria, and viruses • structure and properties of the cell • growth 2. Metabolism • fermentation and anaerobic respiration • methanogenesis and the anaerobic food chain • degradation of polymers • chemolithotophy 3. Microorganisms in relation to the environment • chemotaxis and motility • Elemental cycle of carbon, nitrogen and sulfur • biofilms • symbiotic relationships • symbiotic relationships • symbiotic relationships • thereophiles • hiotechnology 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	СР	2
Language Cycle SoSe Content 1. The procaryotic cell • evolution • taxonomy and specific properties of Archaea, Bacteria, and viruses • structure and properties of the cell • growth 2. Metabolism • fermentation and anaerobic respiration • methanogenesis and the anaerobic food chain • degradation of polymers • chemolithotrophy 3. Microorganisms in relation to the environment • chemotaxis and molility • Elemental cycle of carbon, nitrogen and sulfur • biofilims • symbiotic relationships • extremophiles • biotechnology Literature * Allgemeine Mikrobiologie, 8. Autl., 2007, Fuchs, G. (Hrsg.), Thieme Verlag (54,95 €) • Mikrobiologie, 13 Autl., 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	Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Cycle Content 1. The procaryotic cell evolution 1. The procaryotic cell 1. The procaryoti	Lecturer	Dr. Christian Schäfers
t. The procaryotic cell • evolution • taxonomy and specific properties of Archaea, Bacteria, and viruses • structure and properties of the cell • growth 2. Metabolism • fermentation and anaerobic respiration • methanogenesis and the anaerobic food chain • degradation of polymers • chemolithotrophy 3. Microorganisms in relation to the environment • chemotaxis and motility • Elemental cycle of carbon, nitrogen and sulfur • biofilms • symbiotic relationships • axtremophiles • biotechnology Literature * Allgemeine Mikrobiologie, 8. Aufl., 2007, Fuchs, G. (Hrsg.), Thieme Verlag (54,95 €) • Mikrobiologie, 13 Aufl., 2013, Madigan, M., Martinko, J. M., Stahl, D. A., Clark, D. P. (Hrsg.), ehemals "Brock*, Pearson Verlag (89,95 €) • Taschenlehrbuch Biologie Mikrobiologie, 2008, Munk, K. (Hrsg.), Thieme Verlag	Language	DE
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• Grundlagen der Mikrobiologie, 4. Aufl., 2010, Cypionka, H., Springer Verlag (29,95 €), http://www.grundlagen-der-mikrobiologie.icbm.de/		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
Bioprocess Engineering - Fundamentals (L0841)	Lecture	2	3
Bioprocess Engineering- Fundamentals (L	0842)	Recitation Section (large)	2	1
Bioprocess Engineering - Fundamental Pr	actical Course (L0843)	Laboratory Course	2	2
Module Responsible	Prof. Andreas Liese			
Admission Requirements	none			
Recommended Previous	none, module "organic chemistry", module "fundam	entals for process engineering"		
Knowledge				
Educational Objectives	After taking part successfully, students have reache	d the following learning results		
Professional Competence				
Knowledge	Students are able to describe the basic concepts	s of bioprocess engineering. They are able to classif	y different types of k	kinetics for enzymes
	microorganisms, as well as to differentiate different	types of inhibition. The parameters of stoichiometry an	d rheology can be na	amed and mass trans
	processes in bioreactors can be explained. The s	students are capable to explain fundamental bioproce	ss management, ste	rilization technology
	downstream processing in detail.			
Claille	After a consect it as a relation of the consequence	a alea cid ha a alela ta		
Skills	After successful completion of this module, students	s should be able to		
	 describe different kinetic approaches for gro 	with and substrate-uptake and to calculate the correspo	nding parameters	
	 predict qualitatively the influence of energy 	generation, regeneration of redox equivalents and grow	rth inhibition on the fe	ermentation process
	analyze bioprocesses on basis of stoichiom	etry and to set up / solve metabolic flux equations		
	distinguish between scale-up criteria for diff	erent bioreactors and bioprocesses (anaerobic, aerobic	as well as microaer	obic) to compare the
	well as to apply them to current biotechnical	problem		
	 propose solutions to complicated biotechnol 	logical problems and to deduce the corresponding mod	els	
	to explore new knowledge resources and to			
	identify scientific problems with concrete ind			
	 to document and discuss their procedures a 	s well as results in a scientific manner		
D				
Personal Competence				
Social Competence		I be able to debate technical questions in small teams	to ennance the abili	ty to take position to
	own opinions and increase their capacity for teamw	ork in engineering and scientific environments.		
Autonomy	After completion of this module participants will b	e able to solve a technical problem in a team indepe	endently by organizi	ng their workflow an
	present their results in a plenum.			
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): S	Specialisation Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): S	Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7	semester): Specialisation Process Engineering: Compu	lsory	
	General Engineering Science (German program, 7	semester): Specialisation Bioprocess Engineering: Cor	npulsory	
	Bioprocess Engineering: Core qualification: Compu	ılsory		
	General Engineering Science (English program): S	pecialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): S	pecialisation Process Engineering: Compulsory		
	General Engineering Science (English program, 7 s	semester): Specialisation Process Engineering: Compu	sory	
	General Engineering Science (English program, 7 s	semester): Specialisation Bioprocess Engineering: Com	pulsory	
	Biomedical Engineering: Specialisation Artificial Or	gans and Regenerative Medicine: Compulsory		
	Biomedical Engineering: Specialisation Implants ar	nd Endoprostheses: Elective Compulsory		
	Biomedical Engineering: Specialisation Medical Te			
		ent and Business Administration: Elective Compulsory		
	Technomathematics: Specialisation III. Engineering			



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

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

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



Module M0538: Heat and M	lass Transfer				
No. 1990					
courses		Тур	Hrs/wk	CP	
eat and Mass Transfer (L0101)		Lecture	2	4	
eat and Mass Transfer (L0102)		Recitation Section (small)	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	ng 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 therma radiation. The students have the ability to explain the physical basis for mass transfer in detail and to describe mass transfer qualitative and quantitative busing 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 the 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 the 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 courses thermodynamics, fluid mechanics and chemical process engineering) to solve concrete technical problems. 				
Personal Competence Social Competence					
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-like assignments) and on this basis they can control their learning processes.				
Workload in Hours	Independent Study Time 138, Study Time in Lecture 42				
Credit points	6				
Examination					
Examination duration and scale	120 minutes; theoretical questions and calculations				
Assignment for the Following	General Engineering Science (German program): Specialisation	n Process Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisation				
	General Engineering Science (German program): Specialisation	n Energy and Enviromental Engineering: Co	ompulsory		
	General Engineering Science (German program, 7 semester): S	pecialisation Process Engineering: Compu	lsory		
	General Engineering Science (German program, 7 semester): S				
	General Engineering Science (German program, 7 semester): S	pecialisation Energy and Enviromental Eng	ineering: Compulsor	У	
	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 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 Environmental Engineering: Compulsory				/	
	Technomathematics: Specialisation III. Engineering Science: Ele	ective Compulsory			
	Technomathematics: Core qualification: Elective Compulsory				
	Process Engineering: Core qualification: Compulsory				



Course L0101: Heat and Mass Transfer		
Тур	Lecture	
Hrs/wk	2	
CP	4	
Workload in Hours	Independent Study Time 92, 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	
	2. 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	
	2. VDI-warmeatias	

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	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 The students work on tasks in small groups and present their results in front of all students.		
Literature	H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer VDI-Wärmeatlas		



Module M0546: Thermal Se	paration Processes				
Courses					
Title		Тур	Hrs/wk	СР	
Thermal Separation Processes (L0118)		Lecture	3	3	
Thermal Separation Processes (L0119)		Recitation Section (small)	2	1	
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 telvine and according to the death become and the fellowing				
Educational Objectives	After taking part successfully, students have reached the following le	earning results			
Professional Competence					
Knowledge	The students can distinguish and describe different types of	separation processes such as distillation	, extraction, and ad	sorption	
	The students develop an understanding for the course of c				
	process, the possibilities of energy saving, and the selection			0,	
	They have good knowledge of designing methods for separate.				
Skills	Using the gained knowledge the students can select a reason.	anable system boundary for a given con-	eration process and	can close the accepiated	
		briable system boundary for a given sepa	aralion process and	can close the associated	
	energy and material balances	signing of a congretion process and defin	a the emount of the	aratical atages required	
	The students can use different graphical methods for the des				
	They can select and design a basic type of thermal separations.	ation process for a given case based o	n the advantages a	ind disadvantages of the	
	process	al and the deal and a second at the second a			
	The students are capable to obtain independently the needed.		ources (diagrams ai	nd tables)	
	They can calculate continuous and discontinuous processes				
	The students are able to prove their theoretical knowledge in	·			
	 The students are able to discuss the theoretical background 	and the content of the experimental work	with the teachers in	n colloquium.	
	The students are capable of linking their gained knowledge with the	e content of other lectures and use it to	gether for the solution	on of technical problems.	
	Other lectures such as thermodynamics, fluid mechanics and chemi			·	
Personal Competence					
Social Competence					
30ciai Competence	 The students can work technical assignments in small group 	s and present the combined results in the	e tutorial		
	 The students are able to carry out practical lab work in sma 	Il groups and organize a functional divis	sion of labor betwee	en them. They are able to	
	discuss their results and to document them scientifically in a	report.			
Autonomy	The students are capable to obtain the needed information f	rom suitable sources by themselves and	assess their quality		
	The students can proof the state of their knowledge with exa	·		ning process	
	2 Steeling Steeling State of the Missing William		, ,	3 F	
Workload in Hours	Independent Study Time 92 Study Time in Leasture 00				
	' ' '				
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	ocess Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisation Bio	pprocess Engineering: Compulsory			
	General Engineering Science (German program): Specialisation Er	ergy and Enviromental Engineering: Co	mpulsory		
	General Engineering Science (German program, 7 semester): Spec	ialisation Process Engineering: Compuls	sory		
	General Engineering Science (German program, 7 semester): Spec	ialisation Bioprocess Engineering: Comp	oulsory		
	General Engineering Science (German program, 7 semester): Spec	ialisation Energy and Enviromental Engi	neering: Compulso	ry	
	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 Process Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Speci		•		
	General Engineering Science (English program, 7 semester): Speci		•	v	
	Process Engineering: Core qualification: Compulsory	5, and an including Engli	3. 22pa.301	•	
	. 3 3 - /-				



Course L0118: Thermal Separation	Processes
Тур	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	 Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry's Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann's Enzyklopädie der Technischen Chemie



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



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



Course L1159: Separation Processo	es
Тур	Laboratory Course
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Course work	Compulsory attendence of the colloquia of all experiments and compulsory report.
Lecturer	Prof. Irina Smirnova
Language	DE/EN
Cycle	SoSe
Content	The students work on eight different experiments in this practical course. For every one of the eight experiments, a colloquium takes place in which the
	students explain and discuss the theoretical background and its translation into practice with staff and fellow students.
	The students work small groups with a high degree of division of labor. For every experiment, the students write a report. They receive instructions in
	terms of scientific writing as well as feedback on their own reports and level of scientific writing so they can increase their capabilities in this area.
	Topics of the practical course:
	Introduction in the thermal process engineering and to the main features of separation processes
	Simple equilibrium processes, several steps processes
	Distillation of binary mixtures, enthalpy-concentration diagrams
	Extractive and azeotrope distillation, water vapor distillation, stepwise distillation
	Extraction: separation ternary systems, ternary diagram
	Multiphase separation including complex mixtures
	Designing of separation devices without discrete stages
	Membrane separation
	Energy demand of separation processes
	Advance overview of separation processes
	Selection of separation processes
Literature	G. Brunner: Skriptum Thermische Verfahrenstechnik
	J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980
	Sattler: Thermische Trennverfahren, VCH, Weinheim 1995
	J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998.
	Mersmann: Thermische Verfahrenstechnik, Springer, 1980
	Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997
	Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff,
	Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3.
	R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006.
	Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann"s
	Enzyklopädie der Technischen Chemie
	7



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

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



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

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

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

Literature

lecture notes Raimund Horn

skript Frerich Keil

Books:

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



ourse Loz-4-: One iniour ricuotion L	Engineering (Fundamentals)
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Raimund Horn, Dr. Oliver Korup DE
Language	WiSe WiSe
Content	Fundamentals of chemical reaction engineering, definitions, calculation of species concentrations (reactor, reaction mixture, reactants, products, iner
	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, standar 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, 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 integramethod 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 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 stage 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 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 exotherm reactions limited by chemical equilibrium, design of an adiabatic plug flow reactor, Levenspiel-plots, heat transfer through a reactor wall, heat transfer to 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-isotherm reactors, optimum temperature profile of a reactor)
Literature	lecture notes Raimund Horn
	Aludea Facilia Mail
	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
	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 M0945: Bioprocess				
courses				
itle		Тур	Hrs/wk	СР
oprocess Engineering - Advanced (L110		Lecture	2	4
ioprocess Engineering - Advanced (L110		Recitation Section (small)	2	2
Module Responsible	Prof. An-Ping Zeng			
Admission Requirements	none			
Recommended Previous	Content of module "Biochemical Engineering I"			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follo	wing learning results		
Professional Competence	After a constant and	a alida ta		
Knowledge	After successful completion of this module, students should b	e able to		
	 describe and explain different kinetic approaches for g 	growth and substrate-uptake		
	 identification of scientific problems with concrete indu 	strial use (cultivation of microorganisms and r	nammalian cells)	
	 describe and explain important downstreaming steps 	for proteins and their application as well as b	asic immobilization n	nethods
Skilla	After auguspartul completion of this module, at idente abould be	o abla to		
SKIIIS	After successful completion of this module, students should b	e able to		
	- to identifyy scientific questions or possible practical probler	ns for concrete industrial applications (eg cu	Itivation of microorga	nisms and animal cell
	and to formulate solutions,			
	- To assess the application of scale-up criteria for different ty	pes of bioreactors and processes and to appl	y these criteria to giv	en problems (anaerob
	aerobic or microaerobically)			
	- to formulate questions for the analysis and optimization of re	eal hiotechnological production processes and	propriate solutions	
	to formulate questions for the unarysis and optimization or re	an protectiffological production processes app	oropriate solutions,	
	- To describe the effects of the energy generation, the regene	ration of reduction equivalents , and the grow	th inhibition of the be	havior of microorganis
	and to the total fermentation process qualitatively			
	- Establish material flow balance equations and solve them	to determine the kinetic parameters of differen	nt approaches and to	calculate immobilizati
	and activity yields ,	to determine the kinetic parameters of differen	it approacties and to	odiodidio illillooliizati
	- to select process control strategies (batch , fed-batch , contin	nuity) appropriately and to calculate basic typ	es and evaluate ther	n.
Personal Competence				
Social Competence	After completion of this module participants should be able	to debate technical questions in small teams	to enhance the abilit	y to take position to th
	own opinions and increase their capacity for teamwork.			
Autonomy	After completion of this module participants are able to aquir	e new sources of knowledge and apply their	knowledge to previou	usly unknown issues a
	to present these.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Bioprocess Engineerina: Compulsorv		
Curricula	General Engineering Science (German program, 7 semester)		npulsory	
	Bioprocess Engineering: Core qualification: Compulsory	, grange		
	General Engineering Science (English program): Specialisati	ion Bioprocess Engineering: Compulsory		
	General Engineering Science (English program, 7 semester)	Specialisation Bioprocess Engineering: Com	pulsory	
	Technomathematics: Core qualification: Elective Compulsory			
	Technomathematics: Specialisation III. Engineering Science:	Elective Compulsory		



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

Course L1108: Bioprocess Enginee	ring - Advanced
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. An-Ping Zeng, Prof. Andreas Liese
Language	DE
Cycle	WiSe
Content	 Introduction: state-of-the-art and development trends of microbial and biocatalytic bioprocesses, introduction to the lecture Enzymatic process I: reactor types and criteria for industrial biotransformations (Prof. Liese) Enzymatic process II (Prof. Liese) Immobilization technologies: basic methods for isoltaed enzymes/ cells (Prof. Liese) Anaerobic fermentation processes (Prof. Zeng) Microaerobic bioprocesses: kinetics, energetics, optimal O2-supply and scale-up (Prof. Zeng) Fedbatch process and cultivation with high cell density (Prof. Zeng) Downstream processing of protein bioproduction: basics of chromatography, membrane filtration (Prof. Liese) Cell culture technology and continuous culture: basics, kinetics, media, reactors (Prof. Zeng) Problem-based learning with selected bioprocesses (Prof. Liese, Prof. Zeng) The students present exercises and discuss them with their fellow students and faculty statt. In the PBL part of the class the students discuss scientific questions in teams. They acquire knowledge and apply it to unknown questions, present their results and argue their opinions.
Literature	K. Buchholz, V. Kasche, U. Bornscheuer: Biocatalysts and Enzyme Technology, 2. Aufl. Wiley-VCH, 2012
	H. Chmiel: Bioproze Stechnik, 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		
itle	Typ Hrs/wk	CP
ntroduction to Control Systems (L0654) ntroduction to Control Systems (L0655)	Lecture 2 Recitation Section (small) 2	4 2
Module Responsible		
Admission Requirements		
Recommended Previous		
Knowledge		
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge		E
	 Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of systems 	ilist and second ord
	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 The controllers with the help of heuristic (Ziegler-Nichols) tuning rules The 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 implementa 	tion
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks	liion
	They can do can date contract core (manage control recipies, containing) for carrying car alone	
Personal Competence		
Social Competence		
Autonomy		t when solving give
	problems.	
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Workload in Hours Credit points		
	6	
Credit points	6 Written exam	
Credit points Examination	6 Written exam 120 min	
Credit points Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engi General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in E Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in E Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Develope Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Con Bioprocess Engineering: Core qualification: Compulsory General Engineering: Specialisation Compulsory General Engineering: Core qualification: Compulsory General Engineering: Core qualification: Compulsory General Engineering Science (English program); Semester): Specialisation Compulsory General Engineering Science (En	ulsory neering: Compulso ngineering Science chanical Engineerin ment and Production
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engi General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engi General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engi General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Developi Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Developi Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Con Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (En	ulsory neering: Compulso ngineering Science chanical Engineerin ment and Production
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program; 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 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 Meterials in E Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Developing General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Developing General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Developing General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Combility of Compulsory General Engineering Science (English p	ulsory neering: Compulso ngineering Science chanical Engineerin ment and Production
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engi General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engi General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engi General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Developi Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Developi Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Con Bioprocess Engineering: Core qualification: Compulsory General Engineering Science (En	ulsory neering: Compulsor ngineering Science chanical Engineerin ment and Productio



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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

Process Engineering: Core qualification: Compulsory

e L0654: Introduction to Contr	ol Systems
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems Linear systems, differential equations and transfer functions First and second order systems, poles and zeros, impulse and step response
	Stability Feedback systems Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection Types of feedback, PID control System type and steady-state error, error constants Internal model principle
	Root locus techniques • Root locus plots
	Root locus design of PID controllers Frequency response techniques
	Bode diagram Minimum and non-minimum phase systems Nyquist plot, Nyquist stability criterion, phase and gain margin Loop shaping, lead lag compensation Frequency response interpretation of PID control
	Time delay systems Root locus and frequency response of time delay systems Smith predictor
	Digital control
	Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers
	Software tools Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course
Literature	 Werner, H., Lecture Notes "Introduction to Control Systems" G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009 K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010



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



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

Course L1387: Practical Exercise Environmental Technology		
Тур	Laboratory Course	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Joachim Gerth	
Language	DE	
Cycle	SoSe	
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 Technologie		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Joachim Gerth, Prof. Martin Kaltschmitt, Prof. Kerstin Kuchta	
Language	DE	
Cycle	WiSe	
Content	1. Introductory seminar on environmental science: 2. Environmental impact and adverse effects 3. Wastewater technology 4. Air pollution control 5. Noise protection 6. Waste and recycling management 7. Soil and ground water protection 8. Renewable energies 9. Resource conservation and energy efficiency	
Literature	Förster, U.: Umweltschutztechnik; 2012; Springer Berlin (Verlag) 8., Aufl. 2012; 978-3-642-22972-5 (ISBN)	



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

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



Data reconciliation and data validation	on
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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, Chem. -Ing.-Tech. 72(2000)Nr. 10, S.1157

E. Blass, Entwicklung verfahrenstechnischer Prozesse, Springer-Verlag, 2. Auflage 1997

M. H. Bauer, J. Stichlmair, Chem.-Ing.-Tech., 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, Chem. -Ing.-Tech. 57(1985)Nr. 6, S. 511

K. Machej, G. Fieg, J. Wojcik, Inz. Chem. Proc., 2(1981), S.815-824

S. Meier, G. Kaibel, Chem. -Ing.-Tech. 62(1990)Nr. 13, S.169

J. Mittelstraß, Chem. -Ing.-Tech. 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, Chem.-Ing.-Tech. 61 (1989), Nr. 2, S. 104-112

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

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

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

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

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



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



Module M0670: Particle Ted	chnology and Solids Process Engineering			
Courses				
Title		Тур	Hrs/wk	CP
Particle Technology I (L0434)		Lecture	2 2	3
Particle Technology I (L0435)		Recitation Section (small)	1	1
				2
Module Responsible	Prof. Stefan Heinrich			
Admission Requirements	None			
Recommended Previous	keine			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the followin	g learning results		
Professional Competence				
Knowledge	After successful completion of the module students are able to			
	 name and explain processes and unit-operations of solic characterize particles, particle distributions and to discuss 	, , , , , , , , , , , , , , , , , , , ,		
	Griaracterize particles, particle distributions and to discuss	Their bank properties		
Skills	Students are able to			
CKIIIS	olddonia dro dale to			
	 choose and design apparatuses and processes for solids 	processing according to the desired soli	ds properties of the pro-	duct
	asses solids with respect to their behavior in solids proce	ssing 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				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation	Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation	Energy and Enviromental Engineering: 0	Compulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Bioprocess Engineering: Co	mpulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Energy and Enviromental Er	gineering: Compulsory	1
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Com	oulsory		
	General Engineering Science (English program): Specialisation	Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation	Energy and Enviromental Engineering: C	ompulsory	
	General Engineering Science (English program): Specialisation	Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Sp	ecialisation Process Engineering: Compu	ulsory	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Bioprocess Engineering: Cor	mpulsory	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Energy and Enviromental En	gineering: Compulsory	
	Process Engineering: Core qualification: Compulsory			



Course L0434: Particle Technology	
Тур	Lecture
Hrs/wk	2
СР	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	l
Тур	Recitation Section (small)
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0440: Particle Technology	
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.



odule M0829: Foundation	ns of Management			
le	Typ		Hrs/wk	СР
roduction to Management (L0880)	Typ Lectur	P	3	3
pject Entrepreneurship (L0882)		m-based Learning	2	3
Module Responsible	Prof. Christoph Ihl	_		
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge	Substitution and Substitution and Substitution			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence	The along part accession, cauchin have reached the lengthing reaching			
Knowledge	After taking this module, students know the important basics of many different are	as in Business and Ma	nagement from Plant	ning and Organisation
Miowieage	Marketing and Innovation, and also to Investment and Controlling. In particular the		magement, nom man	iing and Organisation
	manoung and innovation, and also to invostment and controlling. In particular the	y are able to		
	explain the differences between Economics and Management and the sub	disciplines in Managen	nent and to name impo	ortant definitions from
	field of Management			
	explain the most important aspects of and goals in Management and name			
	 describe and explain basic business functions as production, procureme 		chain management,	organization and hum
	ressource management, information management, innovation managemer	•		
	explain the relevance of planning and decision making in Business, esp	. in situations under mu	ultiple objectives and	uncertainty, and expl
	some basic methods from mathematical Finance			
	state basics from accounting and costing and selected controlling methods	•		
Skills	Students are able to analyse business units with respect to different crite	ria (organization, obje	ctives, strategies etc.) and to carry out
	Entrepreneurship project in a team. In particular, they are able to			
	Maria			
	analyse Management goals and structure them appropriately			
	analyse organisational and staff structures of companies	aiak, and mades siels		
	 apply methods for decision making under multiple objectives, under uncert analyse production and procurement systems and Business information sy 			
	 analyse production and procurement systems and Business information sy analyse and apply basic methods of marketing 	sterris		
	select and apply basic methods from mathematical finance to predefined p.	roblems		
	apply basic methods from accounting, costing and controlling to predefined			
	apply basic meaneds norm accounting, cooking and controlling to production	probleme		
Personal Competence				
Social Competence	Students are able to			
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepreneurship project an	d write a coherent renor	t on the project	
	to communicate appropriately and	a wine a concrent repor	ton the project	
	to cooperate respectfully with their fellow students.			
	- to cooperate respectating with their fellow statemen.			
Autonomy	Students are able to			
	work in a team and to organize the team themselves			
	to write a report on their project.			
	to write a report on their project.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 Minuten			
Assignment for the Following		ering: Compulsory		
Curricula				
	General Engineering Science (German program): Specialisation Process Enginee	ring: Compulsory		
	General Engineering Science (German program): Specialisation Bioprocess Engir	neering: Compulsory		
	General Engineering Science (German program): Specialisation Energy and Envir	omental Engineering: C	ompulsory	
	General Engineering Science (German program): Specialisation Civil- and Environ	nental Engeneering: Co	mpulsory	
	General Engineering Science (German program): Specialisation Mechanical Engi	neering: Compulsory		
	General Engineering Science (German program): Specialisation Biomedical Engin	eering: Compulsory		
	General Engineering Science (German program): Specialisation Naval Architectur	e: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Elect	rical Engineering: Comp	oulsory	
	General Engineering Science (German program, 7 semester): Specialisation Proc	ess Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester): Specialisation Biom	edical Engineering: Cor	mpulsory	
	General Engineering Science (German program, 7 semester): Specialisation Nava	Architecture: Compuls	ory	
	General Engineering Science (German program, 7 semester): Specialisation Com	puter Science: Compuls	ory	
	General Engineering Science (German program, 7 semester): Specialisation Biop	ocess Engineering: Cor	mpulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil	Engineering: Compulso	ry	
	General Engineering Science (German program, 7 semester): Specialisation Ener	gy and Enviromental En	gineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Specialisation Mech	anical Engineering, Foo	cus Mechatronics: Cor	npulsory
	General Engineering Science (German program, 7 semester): Specialisation Mech	anical Engineering, Foo	cus Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Specialisation Mech	nanical Engineering, Foo	cus Aircraft Systems E	ngineering: Compulso
	General Engineering Science (German program, 7 semester): Specialisation	Mechanical Engineerin	g, Focus Materials in	Engineering Science
	O			
	Compulsory			
	General Engineering Science (German program, 7 semester): Specialisation N	lechanical Engineering	, Focus Theoretical M	Mechanical Engineeri



Compulsory

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

ompulsory

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

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

Energy and Environmental Engineering: Core qualification: Compulsory

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

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

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

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



Тур	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga
Lecturer	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	WIGH COURT
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. Published April 1988 - 200 Marketing Output Description 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
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept, using their knowledge from the corresponding lecture.
	Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Module M1274: Environme	ntal Technology			
Courses				
Title		Тур	Hrs/wk	СР
Environmental Assessment (L0860)		Lecture	2	2
Environmental Assessment (L1054)		Recitation Section (small)	1	1
Module Responsible	Prof. Martin Kaltschmitt			
Admission Requirements	None			
Recommended Previous	Fundamentals of inorganic/organic chemistry and biology			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results		
Professional Competence				
Knowledge	With the completion of this module the students acquire in-dep	th knowledge of important cause-effect	chains of potential enviro	nmental problems whic
	might occur from production processes, projects or constructio	n measures. They have knowledge abo	ut the methodological div	ersity and are competer
	in dealing with different methods and instruments to assess e	environmental impacts. Besides the stud	lents are able to estimate	the complexity of thes
	environmental processes as well as uncertainties and difficulties	es with their measurement.		
Skills	The students are able to select a suitable method for the resp	pective case from the variety of assessr	nent methods. Thereby th	ey can develop suitable
	solutions for managing and mitigating environmental proble	ems in a business context. They are a	ble to carry out Life Cy	cle Impact Assessment
	independently and can apply the software programs OpenLCA		ning the course the studer	nts have the competenc
	to critically judge research results or other publications on envi	ronmental impacts.		
Personal Competence				
Social Competence	The students are able to discuss the various technical and so	cientific tasks, both subject-specific and	multidisciplinary. They ar	e able to develop joint
•	different solutions and to discuss their theoretical or practical			
	multi-layered issues of the environment protection and the c	oncept of sustainability. Their sensitivit	y and consciousness tow	ards these subjects ar
	raised and which helps to raise their awareness of their future	social responsibilities in their role as eng	jineers.	
Autonomy	The students learn to research, process and present a scient	ific topic independently. They are able	o carry out independent	scientific work. They ca
	solve an environmental problem in a business context and are	able to judge results of other publication	is.	
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			
Curricula	General Engineering Science (German program): Specialisation		•	
	General Engineering Science (German program, 7 semester):			у
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):		Elective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsor	•		
	Energy and Environmental Engineering: Core qualification: Co		0	
	General Engineering Science (English program): Specialisatio	• •		
	General Engineering Science (English program): Specialisatio		•	
	General Engineering Science (English program, 7 semester):			1
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester): S Process Engineering: Core qualification: Elective Compulsory	ppecialisation bioprocess Engineering:	ziective Compulsory	
	Process Engineering: Core qualification: Elective Compulsory Process Engineering: Core qualification: Compulsory			
	1 100000 Engineening. Oure qualification. Compulsory			



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

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



Specialization Electrical Engineering

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

Graduates will have

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

Module M0708: Electrical E	ngineering III: Circuit Theory and Transients			
Courses				
Title		Тур	Hrs/wk	СР
Circuit Theory (L0566)		Lecture	3	4
Circuit Theory (L0567)		Recitation Section (small)	2	2
Module Responsible	Prof. Arne Jacob			
Admission Requirements	none			
Recommended Previous	Electrical Engineering I and II, Mathematics I and II			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following I	earning results		
Professional Competence				
Knowledge	Students are able to explain the basic methods for calculating el periodic signals. They know the methods for transient analysis of frequency behaviour and the synthesis of passive two-terminal-circ	linear networks in time and in frequen		
Skills	The students are able to calculate currents and voltages in linear rable to calculate transients in electrical circuits in time and frequency analyse and to synthesize the frequency behaviour of passive two-	cy domain and are able to explain the re		
Personal Competence Social Competence	Students work on exercise tasks in small guided groups. They are e	encouraged to present and discuss their	r results within the gro	up.
Autonomy	The students are able to find out the required methods for solving lectures continuously by means of short-time tests. This allows th knowledge to other courses like Electrical Engineering I and Mathe	em to control independently their educ		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
	6			
Examination	Written exam			
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): Specialisation El	ectrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation M	echanical Engineering, Focus Mechatro	onics: Compulsory	
	General Engineering Science (German program, 7 semester): Spec	cialisation Mechanical Engineering, Foo	cus Mechatronics: Cor	npulsory
	General Engineering Science (German program, 7 semester): Spec	cialisation Electrical Engineering: Comp	oulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Ele			
	General Engineering Science (English program): Specialisation Me			
	General Engineering Science (English program, 7 semester): Spec			npulsory
	General Engineering Science (English program, 7 semester): Spec		ulsory	
	Computational Science and Engineering: Specialisation Engineerin	ng Sciences: Elective Compulsory		
	Mechatronics: Core qualification: Compulsory	vo Compulação		
	Technomathematics: Specialisation III. Engineering Science: Electi Technomathematics: Specialisation III. Engineering Science: Electi			
		comparisory		



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)
	- L. Moura, I. Darwazeri, Introduction to Linear Grout Analysis and modeling , Amsterdam Newnes (2005)

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



Courses		
itle	Typ Hrs/wk	CP
computer Engineering (L0321) computer Engineering (L0324)	Lecture 3 Recitation Section (small) 1	4 2
Module Responsible		2
Admission Requirements		
Recommended Previous		
Knowledge		
	The successful completion of the labs will be honored during the evaluation of the module's examination according to the fol	lowing rules:
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the su	ccessful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.	
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.	
Educational Objectives	After taking part supposefully, students have reached the following learning results	
Professional Competence		
Knowledge		-level programming dow
rinowicage	gates. The module includes the following topics:	level programming dow
	galos. The modele included the following appear	
	Introduction	
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks	
	Sequential logic: Flip-flops, automata, systematic hardware design	
	Technological foundations Computes with paths and different black to a subtraction and different black to a subtraction and different blacks.	
	 Computer arithmetic: Integer addition, subtraction, multiplication and division Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining 	
	Memories: Memory hierarchies, SRAM, DRAM, caches	
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and	
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a computer systems.	collection of few and sin
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing systems.	ems - from gates and circ
	up to complete processors.	
	After successful completion of the module, the students are able to judge the interdependencies between a physical completion	uter system and the softw
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-co	entric abstraction layers t
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction level	Is have on an entire syste
	performance and to propose feasible options.	
Paramal Commetence		
Personal Competence		
Personal Competence Social Competence		
	Students are able to solve similar problems alone or in a group and to present the results accordingly.	
Social Competence Autonomy	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.	
Social Competence Autonomy Workload in Hours	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56	
Social Competence Autonomy Workload in Hours Credit points	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56	
Social Competence Autonomy Workload in Hours Credit points Examination	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	ulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	ılsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory	·
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory	Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics:	Compulsory : Compulsory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics:	Compulsory : Compulsory ns Engineering: Compuls
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Technomathematics: Specialisation II. Informatics: Elective Compulsory



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

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

Тур	Recitation Section (small)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	
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
	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
	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 shifte
- 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
- 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 M0567: Theoretical	Electrical Engineering I: Time-Independent	t Fields		
Courses				
Title		Тур	Hrs/wk	CP
Theoretical Electrical Engineering I: Time-Independent Fields (L0180)		Lecture	3	5
Theoretical Electrical Engineering I: Time-		Recitation Section (small)	2	1
Module Responsible	Prof. Christian Schuster			
Admission Requirements	Elektrotechnik I, Elektrotechnik II, Mathematik I, Mathematik III			
Recommended Previous	Basic principles of electrical engineering and advanced ma	athematics		
Knowledge				
Educational Objectives	After the line and a consequent line at all and a few sequents and the few	Having Ingeline and the		
Educational Objectives	After taking part successfully, students have reached the fo	llowing learning results		
Professional Competence	Charles to a complete the face demands for any less and the		* - + + i E - -	The constant the
Knowledge	Students can explain the fundamental formulas, relations, principal behavior of electrostatic, magnetostatic, and cu	·	-	
	complex electromagnetic fields by means of superposition			
	independent electromagnetic fields and are able to explica		re aware or approare	is for the theory of time
	The openion of the magnetic fields and and also to expired			
Skills	Students can apply Maxwell's Equations in integral notal	tion in order to solve highly symmetrical, time	e-independent, electro	magnetic field problems.
S.i.i.b				
	Furthermore, they are capable of applying a variety of methods that require solving Maxwell's Equations for more general problems. The students can assess the principal effects of given time-independent sources of fields and analyze these quantitatively. They can deduce meaningful quantities for the			
	characterization of electrostatic, magnetostatic, and electrical flow fields (capacitances, inductances, resistances, etc.) from given fields and dimension			
	them for practical applications.			
Personal Competence				
Social Competence	Students are able to work together on subject related tasks in small groups. They are able to present their results effectively (e.g. during exercise			
	sessions).			
Autonomy	Students are capable to gather necessary information from			
	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 their knowledge obtained in this lecture and the content of other lectures (e.g. Electrical Engineering I, Linear Algebra, and Analysis).			
	their knowledge obtained in this recture and the content of	other rectures (e.g. Electrical Engineering i, Eli	ear Algebra, and Analy	7515).
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): Specialis	sation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semest	er): Specialisation Electrical Engineering: Com	pulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialis			
	General Engineering Science (English program, 7 semeste		oulsory	
	Technomathematics: Specialisation III. Engineering Science	e: Elective Compulsory		



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



Course L0181: Theoretical Electrical Engineering I: Time-Independent Fields			
Тур	Recitation Section (small)		
Hrs/wk	2		
СР	1		
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28		
Lecturer	Prof. Christian Schuster		
0 0	DE		
Cycle			
Content	- Maxwell's Equations in integral and differential notation		
	- Boundary conditions		
	- Laws of conservation for energy and charge		
	- Classification of electromagnetic field properties		
	- Integral characteristics of time-independent fields (R, L, C)		
	- Generic approaches to solving Poisson's Equation		
	- Electrostatic fields and specific methods of solving		
	- Magnetostatic fields and specific methods of solving		
	- Fields of electrical current density and specific methods of solving		
	- Action of force within time-independent fields		
	- Numerical methods for solving time-independent problems		
Literature	- G. Lehner, "Elektromagnetische Feldtheorie: Für Ingenieure und Physiker", Springer (2010)		
	- H. Henke, "Elektromagnetische Felder: Theorie und Anwendung", Springer (2011)		
	- W. Nolting, "Grundkurs Theoretische Physik 3: Elektrodynamik", Springer (2011)		
	- D. Griffiths, "Introduction to Electrodynamics", Pearson (2012)		
	- J. Edminister, " Schaum's Outline of Electromagnetics", Mcgraw-Hill (2013)		
	- Richard Feynman, "Feynman Lectures on Physics: Volume 2", Basic Books (2011)		



ourses				
tle		Тур	Hrs/wk	СР
gnals and Systems (L0432)		Lecture	3	4
gnals and Systems (L0433)		Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch			
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge	The modul is an introduction to the theory of signals and sy	stems. Good knowledge in maths as covere	d by the moduls Mat	hematik 1-3 is expe
	Further experience with spectral transformations (Fourier seri			
Educational Objectives	After taking part successfully, students have reached the following	wing learning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and lin			
	to apply the fundamental transformations of continuous-time a			
	and systems mathematically in both time and image domai		in time domain and i	mage domain which
· · ·	caused by the transition of a continuous-time signal to a discr			
Skills	The students are able to describe and analyse deterministic	•	-	
	can analyse and design basic systems regarding important p		ponse, stability, linear	ity etc They can as
Davidanal Commissioner	the impact of LTI systems on the signal properties in time and	rrequency domain.		
Personal Competence	The students are initially solve as a if a such large			
Social Competence	The students can jointly solve specific problems.			de alexa divisione de a les
Autonomy	The students are able to acquire relevant information from a		roi their level of know	rieage auring the lea
Waydaad in Harra	period by solving tutorial problems, software tools, clicker sys	em.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisat			
Curricula	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program): Specialisation Civil- and Enviromental Engeneering: Compulsory			
			mpulsory	
	General Engineering Science (German program): Specialisat			
	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)			
	General Engineering Science (German program, 7 semester)		•	
	General Engineering Science (German program, 7 semester)			
	General Engineering Science (German program, 7 semester)			mnulsorv
	General Engineering Science (German program, 7 semester)			
	General Engineering Science (German program, 7 semester)			
	General Engineering Science (German program, 7 semes			
	Compulsory		,	g
	General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering, Foo	cus Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semest			
	Compulsory			3 00
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisati	on Civil- and Enviromental Engeneering: Cor	npulsory	
	General Engineering Science (English program): Specialisati	on Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisati	on Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisati	on Computer Science: Compulsory		
	General Engineering Science (English program): Specialisati	on Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program, 7 semester):		-	
	General Engineering Science (English program, 7 semester):			
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	General Engineering Science (English program, 7 semester):	,		
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semes	ier). opecialisation Mechanical Engineering	y, rocus Materials in	ı ⊏ngıneering Scier
	Compulsory General Engineering Science (English program, 7 semester):	Specialization Mechanical Engineering For	ue Machatronias C	anuleon,
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semest	or). Opeciansation iviechanical Engineering.	, rocus ineoretical l	weonanicai ⊏nginee
	Compulsory			
	Compulsory Computational Science and Engineering: Core qualification:	Compulsory		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

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



Module M0748: Materials in	Electrical Engineering			
Courses				
Title		Тур	Hrs/wk	СР
Electrotechnical Experiments (L0714)		Lecture	1	1
Materials in Electrical Engineering (L0685)		Lecture	2	3
Materials in Electrical Engineering (Problem	aterials in Electrical Engineering (Problem Solving Course) (L0687) Recitation Section (small) 2 2			
Module Responsible	Prof. Manfred Eich			
Admission Requirements	None			
Recommended Previous	Highschool level physics and mathematics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following lea	rning results		
Professional Competence				
Knowledge	Students can explain the composition and the structural properties of materials used in electrical engineering. Students can explicate the relevance of mechanical, electrical, thermal, dielectric, magnetic and chemical properties of materials in view of their applications in electrical 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 electrical engineering applications.			
Personal Competence Social Competence				k of the problem solving
Autonomy	Students are capable to extract relevant information from the provided references and to relate this information to the content of the lecture. They can reflect their acquired level of expertise with the help of lecture accompanying measures such as exam typical exam questions. Students are able to connect their knowledge with that acquired from other lectures.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation Elec	trical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Specia		pulsory	
	Electrical Engineering: Core qualification: Compulsory		•	
	General Engineering Science (English program): Specialisation Elect	rical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Special		oulsory	
	Computational Science and Engineering: Specialisation Engineering		,	
	25p.2	Taranson Electro Company		



Course L0714: Electrotechnical Experiments		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
	Dr. Wieland Hingst	
Language		
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
	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Manfred Eich
Language	DE
Cycle	SoSe
Content	The Hamiltonian approach to classical mechanics. Analysis of a simple oscillator.
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.Hagelstein et al., Introductory Applied Quantum and Statistical Mechanics, Wiley 2004
	3.Griffiths, Introduction to Quantum Mechanics, Prentice Hall, 1994
	4.Shankar, Principles of Quantum Mechanics, 2nd ed., Plenum Press, 1994
	5.Fick, Einführung in die Grundlagen der Quantentheorie, Akad. Verlagsges., 1979
	6.Kittel, Introduction to Solid State Physics, 8th ed., Wiley, 2004
	7.Ashcroft, Mermin, Solid State Physics, Harcourt, 1976
	8.Pierret, Semiconductor Fundamentals Vol. 1, Addison Wesley, 1988
	9.Sze, Physics of Semiconductor Devices, Wiley, 1981
	10.Saleh, Teich, Fundamentals of Photonics, 2nd ed., 2007
	11. Joannopoulos, Johnson, Winn Meade, Photonic Crystals, 2nd ed., Princeton Universty Press, 2008
	12.Handley, Modern Magnetic Materials, Wiley, 2000
	13.Wikipedia, Wikimedia



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



Module M0709: Electrical E	ngineering IV: Transmission Lines and	Research Seminar		
Courses				
Title		Тур	Hrs/wk	CP
Research Seminar Electrical Engineering,	Computer Science, Mathematics (L0571)	Seminar	2	2
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 reached	the following learning results		
Professional Competence				
Knowledge	Students can explain the fundamentals of wave pro	pagation on transmission lines at low and high fre	quencies. They are ab	le to analyze circuits with
	transmission lines in time and frequency domain. T	ney can describe simple equivalent circuits of trans	smission lines. They ar	e able to solve problems
	with coupled transmission lines. They can present ar	nd discuss a self-chosen research topic.		
Skills	Students can analyze and calculate the propagation	n of waves in simple circuits with transmission lines	. They are able to ana	llyze circuits in frequency
	domain and with the Smith chart. They can analy	ze equivalent circuits of transmission lines. They	are able to solve pro	blems including coupled
	transmission lines using the vectorial transmission lin	ne equations. They are able to give a talk to professi	onals.	
Personal Competence				
Social Competence	Students can analyze and solve problems in small	groups and discuss their solutions. They can com	pare the learned theor	y with experiments in the
	lecture and discuss it in small groups. They are able	to present a research topic to professionals and disc	cuss it with them.	
Autonomy	The students can solve problems by their own and	are able to acquire skills from the lecture and the	literature. They are ab	le to test their knowledge
	using computer animations. They can test their level	of knowledge by answering short questions and tes	ts during the lecture. Th	ney are able to relate their
	acquired knowledge to other lectures (e.g. Electrica	Engineering I-III and Mathematics I-III). They can to	amiliarize themselves	with a research topic and
	can prepare a presentation.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 8	4		
Credit points	6			
Examination	Written exam			
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): Sp	ecialisation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 s	emester): Specialisation Electrical Engineering: Cor	npulsory	
	Electrical Engineering: Core qualification: Compulso			
	General Engineering Science (English program): Sp	ecialisation Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 se		pulsory	
	Computational Science and Engineering: Specialisa			
	Technomathematics: Specialisation III. Engineering S	• •		
	Technomathematics: Core qualification: Elective Cor	npulsory		

Course L0571: Research Seminar Electrical Engineering, Computer Science, Mathematics		
Тур	Seminar	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dozenten des SD E, 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



Module M0854: Mathematic	es IV			
Courses				
Title		Тур	Hrs/wk	CP
Differential Equations 2 (Partial Differential		Lecture	2	1
Differential Equations 2 (Partial Differential		Recitation Section (small)	1	1
Differential Equations 2 (Partial Differential	Equations) (L1045)	Recitation Section (large)	1 2	1
Complex Functions (L1038)		Lecture Recitation Section (small)	1	1
Complex Functions (L1041)			1	1
Complex Functions (L1042)	<u></u>	Recitation Section (large)	I	ı
Module Responsible	Prof. Anusch Taraz			
Admission Requirements	none			
Recommended Previous	Mathematics 1 - III			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follo	owing learning results		
Professional Competence				
Knowledge				
r.i.o.ii.ougo	 Students can name the basic concepts in Mathematic 	s IV. They are able to explain them using appro	priate examples.	
	 Students can discuss logical connections between th 	ese concepts. They are capable of illustrating t	hese connections w	th the help of examples.
	 They know proof strategies and can reproduce them. 			
_				
Skills	Students can model problems in Mathematics IV with	the help of the concepts studied in this course	. Moreover, they are	capable of solving then
	by applying established methods.		, alog are	or corving titel
			Ma	
	Students are able to discover and verify further logical forms.			
	For a given problem, the students can develop and ex	xecute a suitable approach, and are able to criti	cally evaluate the re	sults.
Personal Competence				
Social Competence				
Social Competence	 Students are able to work together in teams. They are 	capable to use mathematics as a common lan	guage.	
	 In doing so, they can communicate new concepts ac 	cording to the needs of their cooperating partr	ers. Moreover, they	can design examples to
	check and deepen the understanding of their peers.	3 3 3	, ,	g p
	oncon and deepen the understanding of their peers.			
Autonomy			.,	
	Students are capable of checking their understanding	g of complex concepts on their own. They can	specify open ques	tions precisely and know
	where to get help in solving them.			
	 Students have developed sufficient persistence to be 	able to work for longer periods in a goal-orient	ed manner on hard p	problems.
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
	6			
Credit points	0			
Examination	Written exam			
Examination duration and scale	60 min (Complex Functions) + 60 min (Differential Equations	2)		
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisa	tion Mechanical Engineering, Focus Mechatror	nics: Compulsory	
	General Engineering Science (German program): Specialisa			eering: Compulsory
	General Engineering Science (German program): Specialisa	• •	. 3	- ,,
	General Engineering Science (German program, 7 semester		Isony	
			•	maulaan
	General Engineering Science (German program, 7 semester			
	General Engineering Science (German program, 7 semes	ter): Specialisation Mechanical Engineering,	rocus Theoretical I	viechanical Engineering
	Compulsory			
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsor	У	
	Computer Science: Specialisation Computational Mathemati	cs: Elective Compulsory		
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisa	tion Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisa			
			ion. Commute :	
	General Engineering Science (English program): Specialisa	* *		
	General Engineering Science (English program): Specialisa	* *	-	ering: Compulsory
	General Engineering Science (English program, 7 semester)	: Specialisation Electrical Engineering: Compu	sory	
	General Engineering Science (English program, 7 semester)	: Specialisation Mechanical Engineering, Focu	s Mechatronics: Cor	npulsory
	General Engineering Science (English program, 7 semes	ter): Specialisation Mechanical Engineering.	Focus Theoretical I	Mechanical Engineering
	Compulsory			g ···•
	General Engineering Science (English program, 7 semester)	Specialisation Naval Architecture: Compulser	v	
			7	
	Computational Science and Engineering: Specialisation Eng			
	Computational Science and Engineering: Specialisation Cor	·		
	Mechanical Engineering: Specialisation Theoretical Mechan	ical Engineering: Compulsory		
	Mechanical Engineering: Specialisation Mechatronics: Comp	oulsory		
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Theoretical Mechanical Engineering: Technical Complemen	ton, Course Care Studies: Fleetive Compulsor		



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

Course L1042: Complex Functions	ourse 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: Introduction	n to Communications and Random Processes			
Courses				
Title Typ			Hrs/wk	CP
Introduction to Communications and Rand	om Processes (L0442)	Lecture	3	4
Introduction to Communications and Rand	om Processes (L0443)	Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch			
Admission Requirements	None			
Recommended Previous Knowledge	Mathematics 1-3 Signals and Systems Basic knowledge of probability theory			
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence				
Knowledge	The students know and understand the fundamental building blocks of a communications system. They can describe and analyse the individual building blocks using knowledge of signal and system theory as well as the theory of stochastic processes. The are aware of the essential resources are 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 communications system. In particular, they can estimate the required resources in terms bandwidth and power. They are able to assess essential evaluation parameters of a basic communications system such as bandwidth efficiency or 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 approp period by solving tutorial problems, software tools, clicker system.	iate literature sources. They can cor	ntrol their level of know	vledge during the lecture
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 Ele	ctrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Spec	alisation Electrical Engineering: Com	pulsory	
	Computer Science: Specialisation Computer and Software Enginee	ing: Elective Compulsory		
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Ele			
	General Engineering Science (English program, 7 semester): Speci		pulsory	
	Computational Science and Engineering: Specialisation Engineerin			
	Technomathematics: Specialisation III. Engineering Science: Electiv	e Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			



Course L0442: Introduction to Comm	munications 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
Content	Fundamentals of random processes
	Introduction to communications engineering
	Quadrature amplitude modulation
	Description of radio frequency transmission in the equivalent complex baseband
	Transmission channels, channel models
	Analog digital conversion: Sampling, quantization, pulsecode modulation (PCM)
	Fundamentals of information theory, source coding, channel coding
	Digital baseband transmission: Pulse shaping, eye diagramm, 1. and 2. Nyquist condition, matched filter, detection, error probability
	Fundamentals of digital modulation
Literature	K. Kammeyer: Nachrichtenübertragung, Teubner
	P.A. Höher: Grundlagen der digitalen Informationsübertragung, Teubner.
	M. Bossert: Einführung in die Nachrichtentechnik, Oldenbourg.
	J.G. Proakis, M. Salehi: Grundlagen der Kommunikationstechnik. Pearson Studium.
	J.G. Proakis, M. Salehi: Digital Communications. McGraw-Hill.
	S. Haykin: Communication Systems. Wiley
	J.G. Proakis, M. Salehi: Communication Systems Engineering. Prentice-Hall.
	J.G. Proakis, M. Salehi, G. Bauch, Contemporary Communication Systems. Cengage Learning.

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



Courses				
Title		Тур	Hrs/wk	СР
Theoretical Electrical Engineering II: Time-	Dependent Fields (L0182)	Lecture	3	5
Theoretical Electrical Engineering II: Time-	Dependent Fields (L0183)	Recitation Section (small)	2	1
Module Responsible	Prof. Christian Schuster			
Admission Requirements	None			
Recommended Previous	Electrical Engineering I, Electrical Engineering II, Theo	retical Electrical Engineering I		
Knowledge	Mathematics I, Mathematics II, Mathematics III, Mathem	natics IV		
Educational Objectives	After taking part successfully, students have reached the	ne following learning results		
Professional Competence				
Knowledge	Students are able to explain fundamental formulas, rassess the principal behavior and characteristics of q properties of complex electromagnetic fields by mear theory of time-dependent electromagnetic fields and an	uasistationary and fully dynamic fields with reg ns of superposition of solutions for simple field	ard to respective source	s. They can describe
Skills	Students are able to apply a variety of procedures in o can assess the principal effects of given time-dependent the characterization of fully dynamic fields (wave imperwith regard to practical applications.	ent sources of fields and analyze these quantita	tively. They can deduce	meaningful quantities
Personal Competence Social Competence	Students are able to work together on subject relate	d tasks in small groups. They are able to pre	sent their results effectiv	rely (e.g. during exerc
	sessions).			
Autonomy	Students are capable to gather necessary information reflect their knowledge by means of activities that accounte exam. Based on respective feedback, students are acquired knowledge and ongoing research at the Ham	mpany the lecture, such as short oral quizzes d expected to adjust their individual learning pro	uring the lectures and exc cess. They are able to dr	ercises that are relate raw connections between
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70)		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90-150 minutes			
Assignment for the Following	General Engineering Science (German program): Spec	cialisation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 sen		ompulsory	
-	Electrical Engineering: Core qualification: Compulsory		,,	
	General Engineering Science (English program): Spec			
	General Engineering Science (English program, 7 sem		mpulsory	
	Technomathematics: Specialisation III. Engineering Sc			



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



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



Module M1235: Electrical P	ower Systems I			
Courses				
Title		Тур	Hrs/wk	CP
Electrical Power Systems I (L1670)		Lecture	3	4
Electrical Power Systems I (L1671)		Recitation Section (large)	2	2
Module Responsible	Prof. Christian Becker			
Admission Requirements	none			
Recommended Previous	Fundamentals of Electrical Engineering			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the followi	ng learning results		
Professional Competence				
Knowledge	Students are able to give an overview of conventional and	modern electric power systems. They	can explain in detai	I and critically evaluate
	technologies of electric power generation, transmission, storage	, and distribution as well as integration of	equipment into electric	power systems.
Skills	With completion of this module the students are able to apply the	e acquired skills in applications of the des	sian integration devel	onment of electric nower
Onmo	systems and to assess the results.	o adquired simils in applications of the dec	ign, mogration, acver	opinioni oi ciccano power
	eyotome and to access the recurs.			
Personal Competence				
Social Competence	The students can participate in specialized and interdisciplinary	discussions, advance ideas and represen	t their own work result	s in front of others.
Autonomy	Students can independently tap knowledge of the emphasis of t	he lectures.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 - 150 minutes			
Assignment for the Following	General Engineering Science (German program, 7 semester): S	pecialisation Electrical Engineering: Electi	ive Compulsory	
Curricula	Electrical Engineering: Core qualification: Elective Compulsory			
	Energy and Environmental Engineering: Specialisation Energy	Engineering: Elective Compulsory		
	Energy Systems: Specialisation Energy Systems: Elective Comp	pulsory		
	Energy Systems: Specialisation Energy Systems: Elective Comp	pulsory		
	General Engineering Science (English program, 7 semester): S	pecialisation Electrical Engineering: Elective	ve Compulsory	
	Computational Science and Engineering: Specialisation Engine	ering Sciences: Elective Compulsory		
	Renewable Energies: Core qualification: Compulsory			
	Renewable Energies: Core qualification: Compulsory			



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



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



Module M0760: Electronic	Devices			
Courses				
Title		Тур	Hrs/wk	СР
Electronic Devices (L0720)		Lecture	3	4
Electronic Devices (L0721) Module Responsible	Prof. Hoc Khiem Trieu	Problem-based Learning	2	2
Admission Requirements	None			
Recommended Previous		a materiale hacice in colid-etate physics		
Knowledge	Atomic model and quantum theory, electrical currents in solid state materials, basics in solid-state physics Successful participation of Physics for Engineers and Materials in Electrical Engineering or courses with equivalent contents			
Educational Objectives	After taking part successfully, students have reached the following	a learning results		
Professional Competence	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,		
Knowledge				
	Students are able			
	 to represent the basics of semiconductor physics, 			
	to explain the operating principle of important semiconductions	tor devices		
	to explain the operating principle of important semiconduc	ioi devices,		
	to outline device characteristics and equivalent circuits as	well as to explain their derivation and		
	to discuss the limitation of device models.			
Skills				
	Students are capable			
	Students are capable			
	 to apply devices in basic circuits, 			
	 to realize the physical context and to solve complex problem. 	ems by oneself		
Personal Competence				
Social Competence	Students are able to prepare and perform their lab experiments in	team work as well as to present and dis	cuss the results in front	of audience.
Autonomy	Students are capable to acquire knowledge based on literature in	order to prepare their experiments		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70	Total to propare their experiments.		
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Sp		pulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation I	Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Sp	ecialisation Electrical Engineering: Comp	oulsory	
	Computational Science and Engineering: Specialisation Comput	er Science: Elective Compulsory		



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

Course L0721: Electronic Devices	
Тур	Problem-based Learning
Hrs/wk	2
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 M0783: Measureme	nts: Methods and Data Processing			
Courses				
Fitle		Tun	Hrs/wk	СР
E Experimental Lab (L0781)		Typ Laboratory Course	2	2
Measurements: Methods and Data Proces	sing (L0779)	Lecture	2	3
Measurements: Methods and Data Proces	= : :	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 reach	ad the following leaving requite		
· · · · · · · · · · · · · · · · · · ·	After taking part successibility, students have reach	ed the following learning results		
Professional Competence	The students are able to contain the	and the land of th		tall and a talk of and 1 th
Knowledge	·	netrology and the acquisition and processing of measu		
	theory and errors, and explain the processing of st	ochastic signals. Students know methods to digitalize a	nd describe measured	signals.
Skills	The students are able to evaluate problems of met	rology and to apply methods for describing and process	ing of measurements.	
Personal Competence				
Social Competence	The students solve problems in small groups.			
Autonomy	The students can reflect their knowledge and discu	use and avaluate their results		
Autonomy	The students can reliect their knowledge and disct	ass and evaluate their results.		
Workload in Hours	Independent Study Time 110, Study Time in Lectur	re 70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program):	Specialisation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7	semester): Specialisation Electrical Engineering: Elect	ive Compulsory	
	Computer Science: Specialisation Computer and S	Software Engineering: Elective Compulsory		
	Electrical Engineering: Core qualification: Compul	sory		
	General Engineering Science (English program):	Specialisation Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7	semester): Specialisation Electrical Engineering: Electi	ve Compulsory	
	Computational Science and Engineering: Speciali	sation Engineering Sciences: Elective Compulsory		
	Technomathematics: Specialisation III. Engineerin	g Science: Elective Compulsory		
	Technomathematics: Core qualification: Elective C	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: Met	hods 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	



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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

Process Engineering: Core qualification: Compulsory

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



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



Module M0777: Semicondu	ctor Circuit Design			
Courses				
ïtle		Тур	Hrs/wk	СР
emiconductor Circuit Design (L0763)		Lecture	3	4
emiconductor Circuit Design (L0864)		Recitation Section (small)	1	2
Module Responsible	Prof. Wolfgang Krautschneider			
Admission Requirements	none			
Recommended Previous	Fundamentals of electrical engineering			
Knowledge	Basics of physics			
	Dasies of physics			
Educational Objectives	After taking part successfully, students have rea	ached the following learning results		
Professional Competence				
Knowledge	Students are able to explain the function	nality of different MOS devices in electronic circuits.		
		logic circuits and can discuss their advantages and disadva	rantanes	
		nemory circuits and can explain their functionality and spec		
		g circuits functions and where they are applied.		
	Students know the appropriate fields for			
		•		
Skills				
	·	s of different MOS devices and can define the parameters		
		ogic circuits and can design different types of logic circuits.		
	Students can use MOS devices, operation	onal amplifiers and bipolar transistors for specific applicati	ions.	
Personal Competence				
Social Competence				
oodal competence	 Students are able work efficiently in het 	erogeneous teams.		
	 Students working together in small grou 	ips can solve problems and answer professional question	IS.	
Autonomy	Students are able to assess their level of	of knowledge		
Workload in Hours	Independent Study Time 124, Study Time in Le	cture 56		
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program	m): Specialisation Electrical Engineering: Compulsory		
Curricula		m): Specialisation Mechanical Engineering, Focus Mechat		
		m, 7 semester): Specialisation Electrical Engineering: Com		
		m, 7 semester): Specialisation Mechanical Engineering, Fo	ocus Mechatronics: Con	npulsory
	Computer Science: Specialisation Computer at			
	Electrical Engineering: Core qualification: Com			
		n): Specialisation Electrical Engineering: Compulsory		
		n): Specialisation Mechanical Engineering, Focus Mechatr		
		n, 7 semester): Specialisation Electrical Engineering: Com		unulaan.
		n, 7 semester): Specialisation Mechanical Engineering, Fo	cus Mecnatronics: Com	ipuisory
	Mechanical Engineering: Specialisation Mechanical Engineering: Special Engineering: Special Engi	cialisation Computer Science: Elective Compulsory		
	i iviechanicai Engineering: Specialisation Mecha	anomics. Compulsory		
	0 0 1			
	Mechatronics: Core qualification: Compulsory Technomathematics: Core qualification: Electiv	e Compulsory		



Course L0763: Semiconductor Circuit D	
Typ Led	ecture
Hrs/wk 3	
CP 4	
Workload in Hours Inde	dependent Study Time 78, Study Time in Lecture 42
Lecturer Pro	of. Wolfgang Krautschneider
Language DE	E
Cycle Sos	oSe
Literature R. J. HC. K. HC. Y. HC. Y. P.	 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 J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S -G. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 3519004674 Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944 Tietze und Ch. Schenk, E. Gamm, Halbleiterschaltungstechnik, Springer Verlag, 14. Auflage, 2012, ISBN 3540428496 Göbel, Einführung in die Halbleiter-Schaltungstechnik, Berlin, Heidelberg Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208874 ISBN: 88642208867 RL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 RL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 RL: http://ebooks.ciando.com/book/index.cfm/bok_id/319955 RL: http://www.ciando.com/book/index.cfm/bok_id/319955 RL: http://www.ciando.com/img/bo

Course L0864: Semiconductor Circuit Design	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Wolfgang Krautschneider
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



odule M0829: Foundation	ns of Management			
ourses	Typ		Hrs/wk	СР
troduction to Management (L0880)	Typ Lecture		3	3
oject Entrepreneurship (L0882)	Problem-based	Learning	2	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge	After taking this module, students know the important basics of many different areas in Br	usiness and Manage	ment, from Planr	ning and Organisation
	Marketing and Innovation, and also to Investment and Controlling. In particular they are ab	le to		
	explain the differences between Economics and Management and the sub-discipling	oos in Managamant	and to name impe	ertant definitions from t
	field of Management	ies iii Managemeni a	and to name impo	mani delimilons nom
	explain the most important aspects of and goals in Management and name the most important aspects of and goals in Management and name the most important aspects of and goals in Management and name the most important aspects of and goals in Management and name the most important aspects of and goals in Management and name the most important aspects of and goals in Management and name the most important aspects of and goals in Management and name the most important aspects of and goals in Management and name the most important aspects of and goals in Management and name the most important aspects of and goals in Management and name the most important aspects of and goals in Management and name the most important aspects of and goals in Management and name the most important aspects of an additional aspects of a specific aspects of a specific aspects of a specific aspect of the specific aspects of a specific aspect of the spec	st important aspects o	of entreproeurial r	projects
	describe and explain basic business functions as production, procurement and s			
	ressource management, information management, innovation management and management			3
	explain the relevance of planning and decision making in Business, esp. in situations.	-	objectives and	uncertainty, and expl
	some basic methods from mathematical Finance			
	state basics from accounting and costing and selected controlling methods.			
Skills	Students are able to analyse business units with respect to different criteria (org.	anization objective	ctratogics ata) and to carry out
Skills	Entrepreneurship project in a team. In particular, they are able to	amzalion, objectives	s, strategies etc.) and to carry out
	Entrepreneurship project in a team. In particular, they are able to			
	analyse Management goals and structure them appropriately			
	analyse organisational and staff structures of companies			
	apply methods for decision making under multiple objectives, under uncertainty and	d under risk		
	analyse production and procurement systems and Business information systems			
	analyse and apply basic methods of marketing			
	 select and apply basic methods from mathematical finance to predefined problems apply basic methods from accounting, costing and controlling to predefined probler 	ne		
	apply basic methods from accounting, costing and controlling to predefined problem	115		
Personal Competence				
Social Competence	Students are able to			
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepreneurship project and write a	coherent report on t	he 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				
Credit points				
Examination				
Examination duration and scale	90 Minuten			
Assignment for the Following				
Curricula		-		
	General Engineering Science (German program): Specialisation Process Engineering: Co	, ,		
	General Engineering Science (German program): Specialisation Bioprocess Engineering:	. ,	ulooni	
	General Engineering Science (German program): Specialisation Energy and Environmental General Engineering Science (German program): Specialisation Civil- and Environmental Engineering Science (German program): Specialisation Civil- and Environmental Engineering Science (German program): Specialisation Civil- and Environmental Engineering Science (German program): Specialisation Energy and Environmental Engineering Science (German program): Specialisation Civil- and Environmental Engineering Science (German program): Specialisation Engineering		•	
	General Engineering Science (German program): Specialisation Mechanical Engineering:		isory	
	General Engineering Science (German program): Specialisation Biomedical Engineering:			
	General Engineering Science (German program): Specialisation Naval Architecture: Comp			
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering	•	ry	
	General Engineering Science (German program, 7 semester): Specialisation Process Engi	neering: Compulsor	/	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical E			
	General Engineering Science (German program, 7 semester): Specialisation Naval Archite	ecture: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Computer Science	ience: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess E	ngineering: Compul	sory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineer	ering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Energy and E			
	General Engineering Science (German program, 7 semester): Specialisation Mechanical E			
	General Engineering Science (German program, 7 semester): Specialisation Mechanical E			
	General Engineering Science (German program, 7 semester): Specialisation Mechanical E		-	
	General Engineering Science (German program, 7 semester): Specialisation Mechani	ical Engineering, Fo	cus Materials in	Engineering Science
	Compulsory	ores a s		Acceptance of the control of
	General Engineering Science (German program, 7 semester): Specialisation Mechanic	car Engineering, Foo	cus Ineoretical N	nechanical Engineerii



Compulsory

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

impulsory

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory

Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

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

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

 $Technomathematics: Core\ qualification: Compulsory$

Process Engineering: Core qualification: Compulsory



Тур	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga
Lecturer	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	***IOGIOUGE
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management
	Important definitions from Management,
	 Developing Objectives for Business, and their relation to important Business functions
	Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management
	Marketing and Sales
	Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management
	Definitions as information, information systems, aspects of data security and strategic information systems
	Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Pela page of the define PRR of PRR Metalling
	Relevance of marketing, B2B vs. B2C-Marketing
	 different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures
	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	
Language	DE	
Cycle	WiSe/SoSe	
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept, using their knowledge from the corresponding lecture. Project work is carried out in teams with the support of a mentor.	
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.	



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

Course L0640: Electrical Engineering 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-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.	
170		
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).	



Specialization Energy and Environmental Engineering

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

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

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

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

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



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

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

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

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

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

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

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

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

Computer Science: Core qualification: Compulsory

Electrical Engineering: Core qualification: Compulsory

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation II. Informatics: Elective Compulsory

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

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





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 I (L1085) Fundamentals of Materials Science II (Advanced Ceramic Materials, Polymers and Composites) (L0506)		Lecture	2	2
Physical and Chemical Basics of Materials		Lecture	2	2
Module Responsible	Prof. Jörg Weißmüller			
Admission Requirements	None			
Recommended Previous	Highschool-level physics, chemistry und mathematics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The students have acquired a fundamental knowledge on m	etals, ceramics and polymers ar	nd can describe this knowl	edge comprehensively
	Fundamental knowledge here means specifically the issues of a	tomic structure, microstructure, pha	ase diagrams, phase transfo	rmations, corrosion and
	mechanical properties. The students know about the key aspec	ts of characterization methods for	materials and can identify	elevant approaches for
	characterizing specific properties. They are able to trace materials	phenomena back to the underlying	g physical and chemical law	s of nature.
Skills	The students are able to trace materials phenomena back to the	underlying physical and chemical	laws of nature. Materials ph	enomena here refers to
	mechanical properties such as strength, ductility, and stiffness, cl			
	solidification, precipitation, or melting. The students can explain	the relation between processing co	onditions and the materials	microstructure, and they
	can account for the impact of microstructure on the material's beha	avior.		
Personal Competence				
Social Competence	-			
Autonomy	-			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation I	Energy and Enviromental Engineer	ring: Compulsory	
Curricula	General Engineering Science (German program): Specialisation I	Mechanical Engineering: Compulso	ory	
	General Engineering Science (German program): Specialisation I		ory	
	General Engineering Science (German program): Specialisation I			
	General Engineering Science (German program, 7 semester): Spr			
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp.			,
	General Engineering Science (German program, 7 semester): Spi Energy and Environmental Engineering: Core qualification: Comp		aı Engineering: Compulsor)	•
	General Engineering Science (English program): Specialisation E	•	na: Compulsory	
	General Engineering Science (English program): Specialisation M	• •		
	General Engineering Science (English program): Specialisation E			
	General Engineering Science (English program): Specialisation N		,	
	General Engineering Science (English program, 7 semester): Spe		g: Compulsory	
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe	cialisation Naval Architecture: Con	npulsory	
	General Engineering Science (English program, 7 semester): Spe	cialisation Energy and Enviroment	tal Engineering: Compulsory	
	Logistics and Mobility: Specialisation Engineering Science: Electi	ve Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Elec	tive 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 Chemical Basics of Materials Science				
Тур	Lecture			
Hrs/wk	2			
CP	2			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28			
Lecturer	Prof. Stefan Müller			
Language	DE			
Cycle	WiSe			
Content	Motivation: "Atoms in Mechanical Engineering?" Basics: Force and Energy The electromagnetic Interaction "Detour": Mathematics (complex e-funktion etc.) The atom: Bohr's model of the atom Chemical bounds The multi part problem: Solutions and strategies Descriptions of using statistical thermodynamics Elastic theory of atoms Consequences of atomar properties on makroskopic Properties: Discussion of examples (metals, semiconductors, hybrid systems)			
Literature	Für den Elektromagnetismus: Bergmann-Schäfer: "Lehrbuch der Experimentalphysik", Band 2: "Elektromagnetismus", de Gruyter Für die Atomphysik: Haken, Wolf: "Atom- und Quantenphysik", Springer Für die Materialphysik und Elastizität: Hornbogen, Warlimont: "Metallkunde", Springer			



Module M0598: Mechanical	Engineering: Design				
Courses					
Title		Typ	Hrs/wk	CP	
		Typ Lecture	2	1	
Embodiment Design and 3D-CAD (L0268) Mechanical Design Project I (L0695)		Practical Course	3	2	
Mechanical Design Project II (L0592)		Practical Course	3	2	
Team Project Design Methodology (L0267		Problem-based Learning	2	1	
Module Responsible	Prof. Dieter Krause			•	
Admission Requirements	None				
Recommended Previous					
Knowledge	 Fundamentals of Mechanical Engineering Design 				
	Mechanics				
	 Fundamentals of Materials Science 				
	Production Engineering				
Educational Objectives	After taking part successfully, students have reached the followi	ng learning results			
Professional Competence					
Knowledge	After passing the module, students are able to:				
G	, ,				
	explain design guidelines for machinery parts e.g. 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.				
	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,				
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.				
	To not the countries in the work groups of the countries.				
Autonomy	y Students are able				
	 to estimate their level of knowledge using activating me 	thods 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	Energy and Environmental Engineerings C	ampulaan.		
Assignment for the Following					
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 Environmental Engineering: Compulsory				
	Energy and Environmental Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (English program, 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 Environmental Engineering: Compulsory				
	Mechanical Engineering: Core qualification: Compulsory				
	Mechatronics: Core qualification: Compulsory				
	Naval Architecture: Core qualification: Compulsory				



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

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



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

Course L0267: Team Project Design	n Methodology	
Тур	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 M0536: Fundament	als of Fluid Mechanics			
Courses				
Title		Тур	Hrs/wk	СР
Fundamentals of Fluid Mechanics (L0091)		Lecture	2	4
Fluid Mechanics for Process Engineering	(L0092)	Recitation Section (large)	2	2
Module Responsible	Prof. Michael Schlüter			
Admission Requirements	None			
Recommended Previous	Mathematics I+II+III			
Knowledge	Technical Mechanics I+II			
	Technical Thermodynamics I+II			
	 Working with force balances 			
	 Simplification and solving of partial differential equ 	uations		
	Integration			
Educational Objectives	After taking part successfully, students have reached the f	ollowing learning results		
Professional Competence	3,,			
Knowledge	Students are able to:			
	 explain the difference between different types of fleen give an overview for different applications of the R 		ring	
	explain simplifications of the Continuity- and Navie			
	explain empirication of the continuity and many	s. Clones Equation by doing physical boundary	00110110110	
Skills	The students are able to			
	 describe and model incompressible flows mathem 	natically		
	reduce the governing equations of fluid mechanics	s by simplifications to archive quantitative solution	ons e.g. by integration	
	notice the dependency between theory and technic	cal applications		
	 use the learned basics for fluid dynamical application 	tions in fields of process engineering		
Personal Competence				
Social Competence	The students			
oodar competence	The statema			
	are capable to gather information from subject rela-			
	able to work together on subject related tasks in significant.	mall groups. They are able to present their resu	ts effectively in English	n (e.g. during small gro
	exercises)	machines to discuss the colutions exally and to m	toognt the regults	
	 are able to work out solutions for exercises by there 	nserves, 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 expa	nd their knowledge with this literature		
	work on their exercises by their own and to evalua			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points				
Examination	Written exam			
Examination duration and scale	3 hours			
Assignment for the Following	General Engineering Science (German program): Specia			
Curricula	General Engineering Science (German program): Specia	, , ,	Compulação	
	General Engineering Science (German program): Specia General Engineering Science (German program, 7 semes	* *		
	General Engineering Science (German program, 7 semes			
	General Engineering Science (German program, 7 semes			у
	Bioprocess Engineering: Core qualification: Compulsory		Ţ ,	
	Energy and Environmental Engineering: Core qualification	n: Compulsory		
	General Engineering Science (English program): Special	isation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Special	**	Compulsory	
	General Engineering Science (English program): Special			
	General Engineering Science (English program, 7 semes			
	General Engineering Science (English program, 7 semes			
	General Engineering Science (English program, 7 semes Technomathematics: Specialisation III. Engineering Scien		igineering: Compulsor	у
	Process Engineering: Core qualification: Compulsory	ice. Liective Compuisory		
	1 100633 Engineering. Our quantication. Compulsory			



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

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



Module M0610: Electrical M	lachines			
0				
Courses				
Title		Тур	Hrs/wk	CP
Electrical Machines (L0293)		Lecture	3	4
Electrical Machines (L0294)	Prof. Günter Ackermann	Recitation Section (large)	2	2
Module Responsible Admission Requirements	none			
Recommended Previous	Basics of mathematics, in particular complexe numbers, integrals, di	ferentials		
Knowledge	basics of mathematics, in particular complexe numbers, integrals, or	icicitudis		
····ougo	Basics of electrical engineering and mechanical engineering			
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence				
Knowledge	Students can to draw and explain the basic principles of electric and	magnetic fields.		
	They can describe the function of the standard types of electric i	nachines and present the correspor	nding equations and c	haracteristic curves For
	typically used drives they can explain the major parameters of the er	·		
Skills	Students arw able to calculate two-dimensional electric and magne	ic fields in particular ferromagnetic ci	ircuits with air gap. For	this they apply the usual
	methods of the design auf electric machines.			
	They can calulate the operational performance of electric machines	from their given characteristic data ar	nd selected quantities a	nd characteristic curves
	They apply the usual equivalent circuits and graphical methods.			
Personal Competence				
Social Competence				
Autonomy				
	performance of electric machines from the characteristic 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 En	ergy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specialisation Me	chanical Engineering: Elective Comp	oulsory	
	General Engineering Science (German program, 7 semester): Speci	alisation Energy and Enviromental E	ngineering: Compulsor	/
	General Engineering Science (German program, 7 semester): Speci	alisation Mechanical Engineering: El	ective Compulsory	
	Electrical Engineering: Core qualification: Elective Compulsory			
	Energy and Environmental Engineering: Core qualification: Compul			
	General Engineering Science (English program): Specialisation Eng			
	General Engineering Science (English program): Specialisation Med			
	General Engineering Science (English program, 7 semester): Specia			,
	General Engineering Science (English program, 7 semester): Specia		ective Compulsory	
	Computational Science and Engineering: Specialisation Engineerin	•		
	Logistics and Mobility: Specialisation Engineering Science: Elective	Compulsory		
	Mechanical Engineering: Core qualification: Elective Compulsory			
	Mechatronics: Core qualification: Compulsory			



Course L0293: Electrical Machines	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	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 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) Renewable Energy (L1434)		Lecture Recitation Section (small)	2 1	2
Module Responsible	Prof. Martin Kaltschmitt	Heditation Section (Smail)	1	1
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence	The lating part edecederary, edacone have reached and	o to to thing to an imag to contain		
Knowledge	With completion of this module, the students can provide an overview of characteristics of energy systems and their economic efficiency. They car explain the issues occurring in this context. Furthermore, they can explain details of power generation, power distribution and power trading wih regard to subject-related contexts. The students can explain these aspects, which are applicable to many energy systems in general, especially for renewable energy systems and critical discuss them. Furthermore, the students can explain the environmental benefits from the use of such systems.			
Skills	Students are able to apply methodologies for detailer Furthermore, they can evaluate energy systems tech Therefore, they can choose the necessary subject-speci. The students are able to explain questions and possible into the right context.	inically, environmentally and economically an ific calculation rules, also for not standardized so	d design them under lutions of a problem.	certain given conditions
Personal Competence				
Social Competence	The students are able to analyze suitable technical	alternatives and to assess them with techn	ical, economical and	ecological criteria unde
,	sustainability aspects. This allows them to make an effe			•
Autonomy	Students can independently exploit sources , acquire th	e particular knowledge about the subject area a	nd transform it to new qu	uestions.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	3 hours written exam			
Assignment for the Following	General Engineering Science (German program): Speci	alisation Energy and Enviromental Engineering	Compulsory	
Curricula	General Engineering Science (German program, 7 sem	ester): Specialisation Energy and Enviromental	Engineering: Compulso	ry
	General Engineering Science (German program, 7 sem	ester): Specialisation Mechanical Engineering, F	Focus Energy Systems:	Elective Compulsory
	Energy and Environmental Engineering: Core qualificat			
	General Engineering Science (English program): Specia	alisation Energy and Enviromental Engineering:	Compulsory	
	General Engineering Science (English program, 7 seme	ester): Specialisation Energy and Enviromental E	Engineering: Compulsor	у
	General Engineering Science (English program, 7 seme			

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 Power distribution "classic" distribution of electrical energy challenges of fluctuating electricity generation by distributed systems (electricity market, electricity stock exchange, emissions trading) District heating industry Legal and administrative aspects Energy Act support instruments for renewable energy CHP Act Cost and efficiency calculation
Literature	Folien der Vorlesung



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

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

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



Module M0538: Heat and M	lass Transfer			
Courses				
Γitle		Тур	Hrs/wk	СР
Heat and Mass Transfer (L0101)		Lecture	2	4
Heat and Mass Transfer (L0102)		Recitation Section (small)	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 followin	g learning results		
Professional Competence				
Knowledge	The students are capable of explaining qualitative and	determining quantitative heat transfer in	procedural apparatu	ıs (e. g. heat exchan
	chemical reactors).	gotog quantatavo noat aanolo:	procedura, apparate	o (o. g. noar oxonan
	They are capable of distinguish and characterize different	t kinds of heat transfer mechanisms name	ely heat conduction, l	neat transfer and ther
	radiation.			
	The students have the ability to explain the physical basi	s for mass transfer in detail and to describe	e mass transfer quali	tative and quantitative
	using suitable mass transfer theories.			
	They are able to depict the analogy between heat- and m	ass transfer and to describe complex linke	d processes in detail	
Skills	The students are able to set reasonable system boundary.	ries for a given transport problem by usin	ng the gained knowle	edge and to balance
	corresponding energy and mass flow, respectively.	nee ie. a given tanepert presiem by den	ng and gamed anom	ougo and to balance
	They are capable to solve specific heat transfer problem	s (e.g. heated chemical reactors, temper	ature alteration in flu	ids) and to calculate
	corresponding heat flows.			
	Using dimensionless quantities, the students can execute	scaling up of technical processes or appa	aratus.	
	They are able to distinguish between diffusion, convecting	ve mass transition and mass transfer. The	ey can use this know	ledge for the descrip
	and design of apparatus (e.g. extraction column, rectificat	on column).		
	In this context, the students are capable to choose are		d mass exchanger f	or a specific applica
	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 knowledge of other courses (In particular the courses). 			
	thermodynamics, fluid mechanics and chemical process			in particular the cour
	and modification and process of	inginosinig, to convergence to initial pr	00.00.	
Personal Competence				
Social Competence	• The students are capable to work an aubject apolific about	llanges in teams and to present the result	to orally in a raccana	ble manner to tutore
	 The students are capable to work on subject-specific cha other students. 	nenges in teams and to present the result	is orally iii a reasona	ble manner to tutors a
	oner students.			
Autonomy				
	The students are able to find and evaluate necessary info			
	They are able to prove their level of knowledge during the state of the state		dure continuously (d	clicker-system, exam-
	assignments) and on this basis they can control their lear	ing processes.		
Workload in Hours	Independent Study Time 138, Study Time in Lecture 42			
Credit points	6			
Examination				
Examination duration and scale	120 minutes; theoretical questions and calculations	Burres Frederick Control		
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation		omoulsory	
	General Engineering Science (German program, 7 semester): Sp	• •		
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp			у
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Com	oulsory		
	General Engineering Science (English program): Specialisation	Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation		mpulsory	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): Sp			
	General Engineering Science (English program, 7 semester): Sp			
	General Engineering Science (English program, 7 semester): Sp Technomathematics: Specialisation III. Engineering Science: Ele	**	meemig: Compulsor	у
	Technomathematics: Specialisation III. Engineering Science: Ele Technomathematics: Core qualification: Elective Compulsory	ouvo oompulaory		
	Draces Engineering Core qualification, Cores 1500			

Process Engineering: Core qualification: Compulsory



Course L0101: Heat and Mass Transfer		
Тур	Lecture	
Hrs/wk	2	
CP	4	
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	WiSe	
Content	1. Heat transfer Introduction, one-dimensional heat conduction Convective heat transfer Multidimensional heat conduction Non-steady heat conduction Thermal radiation Mass transfer one-way diffusion, equimolar countercurrent diffusion boundary layer theory, non-steady mass transfer Heat and mass transfer single particle/ fixed bed Mass transfer and chemical reactions	
Literature	H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer VDI-Wärmeatlas	

Course L0102: Heat and Mass Trans			
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	1. Heat transfer		
	Introduction, one-dimensional heat conduction		
	Convective heat transfer		
	Multidimensional heat conduction		
	Non-steady heat conduction		
	Thermal radiation		
	2. 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		
	The students work on tasks in small groups and present their results in front of all students.		
Literature	H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer		
	2. VDI-Wärmeatlas		
	E. Formanioada		



Module M0546: Thermal Se	eparation Processes			
Courses				
Title		Тур	Hrs/wk	СР
Thermal Separation Processes (L0118)		Lecture	3	3
Thermal Separation Processes (L0119)		Recitation Section (small)	2	1
Thermal Separation Processes (L0141)		Recitation Section (large)	1	1
Separation Processes (L1159)		Laboratory Course	1	1
Module Responsible	Prof. Irina Smirnova			
Admission Requirements	None			
Recommended Previous Knowledge	Recommended requirements: Thermodynamics III			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	<u> </u>		
Knowledge				
	The students can distinguish and describe different types o The students develop an understanding for the course of process, the possibilities of energy saving, and the selectio They have good knowledge of designing methods for sepa	concentration during a separation proces n of separation systems		
Skills	Using the gained knowledge the students can select a reasenergy and material balances The students can use different graphical methods for the definition of the definition of the definition of the students are capable to obtain independently the need. They can calculate continuous and discontinuous processe. The students are able to prove their theoretical knowledge. The students are able to discuss the theoretical background. The students are capable of linking their gained knowledge with the other lectures such as thermodynamics, fluid mechanics and chemical capable.	esigning of a separation process and defining a significant of the process for a given case based of the content of the experimental work.	ne the amount of the in the advantages a ources (diagrams an	oretical stages required and disadvantages of the d tables)
Personal Competence Social Competence	The students can work technical assignments in small grou The students are able to carry out practical lab work in sm			n them. They are able to
	discuss their results and to document them scientifically in	a report.		
Autonomy	The students are capable to obtain the needed information The students can proof the state of their knowledge with ex	•	, ,	ing process
Workload in Hours	Independent Study Time 82, Study Time in Lecture 98			
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 P	rocess Engineering: Compulsorv		
Curricula	General Engineering Science (German program): Specialisation B			
	General Engineering Science (German program): Specialisation E		mpulsory	
	General Engineering Science (German program, 7 semester): Spe	**		
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): Spe	, , , , , ,		у
	Bioprocess Engineering: Core qualification: Compulsory	5, 4 Elig	. 3. 22pa.301	•
	Energy and Environmental Engineering: Core qualification: Comparisory	Ilsory		
	General Engineering Science (English program): Specialisation Bi	*		
	General Engineering Science (English program): Specialisation En		moulsory	
			привогу	
	General Engineering Science (English program): Specialisation Program 7 semesters: Specialisation Prog		or.	
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): Spec			_
	General Engineering Science (English program, 7 semester): Spec	bansation Energy and Enviromental Engi	neening: Compulsor)	,
	Process Engineering: Core qualification: Compulsory			



Course L0118: Thermal Separation	Processes
Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry's Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann's Enzyklopädie der Technischen Chemie



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



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



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



Module M0639: Gas and St	eam Power Plants			
Courses				
Title		Тур	Hrs/wk	СР
Gas and Steam Power Plants (L0206)		Lecture	3	4
Gas and Steam Power Plants (L0210)		Recitation Section (large)	2	2
Module Responsible	Prof. Alfons Kather			
Admission Requirements	None			
Recommended Previous				
Knowledge	"Technical Thermodynamics I and II"			
	• "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 p	ant, describe the various
	types of power plant and the layout of the steam generator bloc	and determine the operation character	istics of the power pla	ant. Additionally they car
	describe the exhaust gas cleaning apparatus and other environ			sibilities of conventiona
	fossil-fuelled power plants and regenerative (solar, wind) power p	lants or plants equipped with Carbon Ca	pture and Storage.	
	The students can on a basic level explain principles, operation	and design of turbomachinery. They are	able to describe the	environmental impacts o
	acidification, fine particulate or CO2 emissions and the resulting	climatic effects. They are able to name	and discuss the chall	enges in plant operation
	from interconnecting conventional power plants and renewable	energy sources and can name the opti-	mal technical options	for providing security of
	supply and network stability, also with economics considered.			
Skills	The students are able, using theories and methods of the ene	ray technology from fossil fuels and ba	sed on deen knowle	dge on the function and
S.i.iib	construction of gas and steam power plants, to identify basic			
	solutions. Through analysis of the problem and exposure to the			
	endowed with the capability and methodology to develop reali			
	production of heat. From the technical basics the students become			
	the energy-political triangle (economy, secure supply and enviror	mental protection).		
	The students are able to bishlight secrets of the desire	I development of newsy plant avalors	المحمدال والمحمد محالا حالان	
	The students are able to highlight aspects of the design and		with the specialised	soilware suite EBSILON
	Professional TM and to independently program simplified power p	ant process simulations.		
	The students are able to do simplified calculations of turbo machi	nery as either an overall plant or as indivi	dual stages.	
Personal Competence				
Social Competence	The students are able to solve subject-specific exercises in small	s groups and can present their common r	esults orally.	
	The students are able to analyze suitable technical alternatives	to reduce the environmental and encial	footprint of their eng	neering activities and to
	support the energy revolution effectively.	to reduce the environmental and social	lootpillit of their eng	meening activities and to
Autonomy	The students assisted by the tutors will be able to develop alon	·		•
	theoretical and practical knowledge from the lecture is conso	·		
	conditions highlighted. The students are able to analyse indep	endently the operational performance of	if steam power plant	and calculate 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	Written examination of 120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester): Sp		ous Energy Systems: t	Lie Cuive Compulsory
	Energy and Environmental Engineering: Core qualification: Comp General Engineering Science (English program): Specialisation I		ompulsory	
	General Engineering Science (English program): Specialisation I			
	General Engineering Science (English program, 7 semester): Spi			,
	General Engineering Science (English program, 7 semester): Spi General Engineering Science (English program, 7 semester): Spi			
	Mechanical Engineering: Specialisation Energy Systems: Compu		as Energy Oysteins. L	.oovo oompulaary
		,		



se L0206: Gas and Steam Pow	er Plants	
Тур	Lecture	
Hrs/wk	3	
СР	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 shermal 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 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 The environmental impact of acidification, fine particulate or CO ₂ emissions and the resulting climatic effects are a special focus of the lecture and lecture hall exercise. The challenges in plant operation from interconnecting conventional power plants and renewable energy sources are discu	
	and the technical options for providing security of supply and network stability are presented, also under consideration of cost effectiveness. In critical review, focus is especially placed on the compatibility of the different solutions with the environment and climate. With this, the awareness for responsibility of an engineer's own actions are emphasized and the potential extent of the different solutions presented clearly.	
	A multi-day excursion within the framework of the lecture is planned for those students that are interested. The students thus get direct contact with whole subject field of gas and steam power plants. Through discussions with plant personnel the students are able to obtain an overview on operation problems and their solution approach.	
	This activity hinges, however, upon the availability of support financing and as such it cannot always be guaranteed.	
Literature	Kalide: Kraft- und Arbeitsmaschinen Thomas, H.J.: Thermische Kraftanlagen. Springer-Verlag, 1985 Strauß, K.: Kraftwerkstechnik. Springer-Verlag, 2006 Kuceler und Philippen: Energietechnik. Springer-Verlag, 1990	
	 Kugeler und Phlippen: Energietechnik. Springer-Verlag, 1990 T. Bohn (Hrsg.): Handbuchreihe Energie, Band 7: Gasturbinenkraftwerke, Kombikraftwerke, Heizkraftwerke und Industriekraftwerke, Techn 	

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se L0210: Gas and Steam Pow	Plants
Тур	Recitation Section (large)
Hrs/wk	2
CP	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
	lecture hall exercise. The challenges in plant operation from interconnecting conventional power plants and renewable energy sources are discus
	and the technical options for providing security of supply and network stability are presented, also under consideration of cost effectiveness. In
	critical review, focus is especially placed on the compatibility of the different solutions with the environment and climate. With this, the awareness for
	responsibility of an engineer's own actions are emphasized and the potential extent of the different solutions presented clearly.
	Within the framework of the exercise the students learn the use of the specialised software suite EBSILON Professional TM. With this tool small tasks
	solved on the PC, to highlight aspects of the design and development of power plant cycles. The students present their results orally and can afterware
	ask questions and get feedback. The course work has a positive effect on the students final grade.
Literature	Skripte
	Kalide: Kraft- und Arbeitsmaschinen
	Thomas, H.J.: Thermische Kraftanlagen. Springer-Verlag, 1985
	Strauß, K.: Kraftwerkstechnik. Springer-Verlag, 2006
	Kugeler und Phlippen: Energietechnik. Springer-Verlag, 1990
	 T. Bohn (Hrsg.): Handbuchreihe Energie, Band 7: Gasturbinenkraftwerke, Kombikraftwerke, Heizkraftwerke und Industriekraftwerke, Technisch

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



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



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

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



Module M1275: Environme	ntal Technology			
Courses				
Title		Тур	Hrs/wk	CP
Practical Exercise Environmental Technol	ogy (L1387)	Laboratory Course	1	1
Environmental Technologie (L0326)		Lecture	2	2
Module Responsible	Dr. Joachim Gerth			
Admission Requirements	None			
Recommended Previous	Fundamentals of inorganic/organic chemistry and biology			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following I	earning results		
Professional Competence				
Knowledge	With the completion of this modul the students obtain profound k	nowledge of environmental technolo	gy. They are able to d	escribe the behaviour of
	chemicals in the environment. Students can give an overview of	scientific disciplines involved. They	can explain terms and	allocate them to related
	methods.			
01.71	Outline to the second of the s			data anti-contra da calcada de la contra d
Skills	Students are able to propose appropriate management and mitiga	·	•	•
	parameters and to assess the potential of pollutants to migrate			•
	Environmental Technology contributes to sustainable development	and they can present and detend the	ise opinons in front of a	nd against the group.
Personal Competence				
Social Competence	The students are able to discuss the various technical and scientific tasks, both subject-specific and multidisciplinary. They are able to develop differen			
	approaches to the task as a group as well as to discuss their theore	tical or practical implementation.		
Autonomy	Students can independently exploit sources about of the subject, ac	quire the particular knowledge and tr	anfer it to new problem	S.
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Examination	Written exam			
Examination duration and scale	1 hour written exam			
Assignment for the Following	General Engineering Science (German program): Specialisation Er	ergy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specialisation Pr	ocess Engineering: Elective Compuls	ory	
	General Engineering Science (German program, 7 semester): Spec	ialisation Energy and Enviromental E	ngineering: Compulsor	y
	General Engineering Science (German program, 7 semester): Spec	ialisation Process Engineering: Elect	ive Compulsory	
	General Engineering Science (German program, 7 semester): Spec	ialisation Bioprocess Engineering: El	ective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsory			
	Energy and Environmental Engineering: Core qualification: Compu	sory		
	General Engineering Science (English program): Specialisation En	ergy and Enviromental Engineering:	Compulsory	
	General Engineering Science (English program): Specialisation Program	cess Engineering: Elective Compuls	ory	
	General Engineering Science (English program, 7 semester): Spec	alisation Energy and Enviromental E	ngineering: Compulsor	у
	General Engineering Science (English program, 7 semester): Spec	alisation Process Engineering: Electi	ve Compulsory	
	General Engineering Science (English program, 7 semester): Spec	alisation Bioprocess Engineering: Ele	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 Technologie	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Joachim Gerth, Prof. Martin Kaltschmitt, Prof. Kerstin Kuchta
Language	DE
Cycle	WiSe
Content	1. Introductory seminar on environmental science: 2. Environmental impact and adverse effects 3. Wastewater technology 4. Air pollution control 5. Noise protection 6. Waste and recycling management 7. Soil and ground water protection 8. Renewable energies 9. Resource conservation and energy efficiency
Literature	Förster, U.: Umweltschutztechnik; 2012; Springer Berlin (Verlag) 8., Aufl. 2012; 978-3-642-22972-5 (ISBN)



Courses			
Title	Typ Hrs/	/wk	CP
ntroduction to Control Systems (L0654)	Lecture 2 Recitation Section (small) 2		4 2
atroduction to Control Systems (L0655)			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 process.	roperties of	f first and second ord
	systems		
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency results.	sponse and	d root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.		
	They can explain the role of the phase margin in analysis and synthesis of control loops		
	They can explain the way a PID controller affects a control loop in terms of its frequency response		
	They can explain issues arising when controllers designed in continuous time domain are implemented 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 technic	iques	
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital	implement	ation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks		
Personal Competence			
Social Competence	Students can work in small groups to jointly solve technical problems, and experimentally validate their controller design		
Autonomy	Students can obtain information from provided sources (lecture notes, software documentation, experiment guides	s) and use	it when solving giv
	problems.		
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Examination	Written exam		
Examination duration and scale	120 min		
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Co	ompulsory	
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro	nics: Comp	oulsory
			•
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro	anics: Com	pulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha	anics: Comp ystems Eng	pulsory pineering: Compulso
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy	anics: Comp ystems Eng	pulsory pineering: Compulso
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ma	anics: Com ystems Eng aterials in E	pulsory jineering: Compulso Engineering Scienc
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ma Compulsory	anics: Com ystems Eng aterials in E	pulsory jineering: Compulso Engineering Scienc
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ma Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoremset Specialisation Mech	anics: Comp ystems Eng aterials in E	pulsory jineering: Compulso Engineering Scienc ochanical Engineeri
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ma Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theo Compulsory	anics: Comp ystems Eng aterials in E	pulsory jineering: Compulso Engineering Scienc ochanical Engineeri
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ma Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theo Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produ	anics: Comp ystems Eng aterials in E oretical Me	pulsory jineering: Compulsor Engineering Scienc chanical Engineeri
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ma Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theo Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produ Compulsory	anics: Comp ystems Eng aterials in E oretical Me	pulsory jineering: Compulsor Engineering Scienc chanical Engineeri
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	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ma Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theo Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sy Bioprocess Engineering: Core qualification: Compulsory	anics: Comp ystems Eng aterials in E oretical Me	pulsory jineering: Compulsor Engineering Scienc chanical Engineeri
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ma Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theo Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory	anics: Comp ystems Eng aterials in E oretical Me	pulsory jineering: Compulsor Engineering Science chanical Engineering chanical Engineering chanical Producti
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ma Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theo Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory	anics: Comp ystems Eng aterials in E oretical Me	pulsory jineering: Compulsor Engineering Science chanical Engineering chanical Engineering chanical Producti
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Macompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theocompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory	anics: Comp ystems Eng aterials in E oretical Me	pulsory jineering: Compulsor Engineering Science chanical Engineering chanical Engineering chanical Producti
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Macompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theocompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory	anics: Comp ystems Eng aterials in E oretical Me	pulsory jineering: Compulsor Engineering Science chanical Engineering chanical Engineering
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Macompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theocompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory	anics: Comp ystems Eng aterials in E oretical Me	pulsory jineering: Compulsor Engineering Science chanical Engineering chanical Engineering
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Macompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theocompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Productomy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	anics: Comp ystems Eng aterials in E oretical Me	pulsory jineering: Compulsor Engineering Science chanical Engineering chanical Engineering
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Macompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theocompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 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 Bioprocess Engineering: Compulsory	anics: Comp ystems Eng aterials in E oretical Me	pulsory jineering: Compulsor Engineering Science chanical Engineering chanical Engineering
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Macompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theocompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Productompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory	anics: Comp ystems Eng aterials in E oretical Me	pulsory jineering: Compulso Engineering Scienc chanical Engineerin
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatro General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomecha General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Sy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Macompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theocompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Productomy General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Sy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 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 Dioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory	anics: Com ystems Eng sterials in E oretical Me uct Develop ystems: Co	pulsory jineering: Compulso Engineering Scienc chanical Engineerin



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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

Process Engineering: Core qualification: Compulsory

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



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



Module M0670: Particle Ted	chnology and Solids Process Engineering			
2				
Courses				
Title		Тур	Hrs/wk	СР
Particle Technology I (L0434) Particle Technology I (L0435)		Lecture Recitation Section (small)	2 1	3 1
Particle Technology I (L0440)		Laboratory Course	2	2
Module Responsible	Prof. Stefan Heinrich	East along Source		_
Admission Requirements	None			
Recommended Previous	keine			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	After successful completion of the module students are able to			
	 name and explain processes and unit-operations of solids 	process engineering		
	characterize particles, particle distributions and to discuss			
	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
Skills	Students are able to			
	choose and design apparatuses and processes for solids		ids properties of the pro	duct
	asses solids with respect to their behavior in solids proces	sing steps		
	 document their work scientifically. 			
Personal Competence				
Social Competence	The students are able to discuss scientific topics orally with other students or scientific personal and to develop solutions for technical-scientific issues in			
	a group.			
Autonomy				
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 f			
Curricula	General Engineering Science (German program): Specialisation I			
	General Engineering Science (German program): Specialisation I			
	General Engineering Science (German program, 7 semester): Spo		•	
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory			
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Comp	•		
	General Engineering Science (English program): Specialisation E		Compulsory	
	General Engineering Science (English program): Specialisation E General Engineering Science (English program): Specialisation F	**	Joinpuisory	
	General Engineering Science (English program): Specialisation P General Engineering Science (English program, 7 semester): Spe		uleory	
	General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Spe		•	
	General Engineering Science (English program, 7 semester): Spe			
	Process Engineering: Core qualification: Compulsory	oranoanon Energy and Environmental El	iginosinig. Oonipulsory	
	1 100000 Engineering. Oore qualification. Compulsory			



Course L0434: Particle Technology	
Тур	Lecture
Hrs/wk	2
СР	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	ourse 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	
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		Тур	Hrs/wk	СР
Environmental Assessment (L0860)		Lecture	2	2
Environmental Assessment (L1054)		Recitation Section (small)	1	1
Module Responsible	Prof. Martin Kaltschmitt			
Admission Requirements	None			
Recommended Previous	Fundamentals of inorganic/organic chemistry and biology			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	With the completion of this module the students acquire in-de	pth knowledge of important cause-effect c	hains of potential enviro	nmental problems which
	might occur from production processes, projects or construction	on measures. They have knowledge abou	t the methodological div	ersity and are competer
	in dealing with different methods and instruments to assess	environmental impacts. Besides the stude	ents are able to estimate	the complexity of these
	environmental processes as well as uncertainties and difficult	ies with their measurement.		
Skills	The students are able to select a suitable method for the res	spective case from the variety of assessme	ent methods. Thereby th	ey can develop suitable
	solutions for managing and mitigating environmental problem	ems in a business context. They are ab	le to carry out Life Cy	cle Impact Assessment
	independently and can apply the software programs OpenLC.		ng the course the stude	nts have the competenc
	to critically judge research results or other publications on env	rironmental impacts.		
Personal Competence				
Social Competence	The students are able to discuss the various technical and s	cientific tasks, both subject-specific and n	nultidisciplinary. They a	e able to develop joint
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	different solutions and to discuss their theoretical or practica			
	multi-layered issues of the environment protection and the	·		-
	raised and which helps to raise their awareness of their future			,
	·			
Autonomy	The students learn to research, process and present a scien	tific topic independently. They are able to	carry out independent	scientific work. They car
•	solve an environmental problem in a business context and are			•
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): Specialisati	on Energy and Enviromental Engineering	Compulsory	
Curricula	General Engineering Science (German program): Specialisati	ion Process Engineering: Elective Compul	sory	
	General Engineering Science (German program, 7 semester):	Specialisation Energy and Enviromental I	Engineering: Compulsor	у
	General Engineering Science (German program, 7 semester):	Specialisation Process Engineering: Elec	tive Compulsory	
	General Engineering Science (German program, 7 semester):	Specialisation Bioprocess Engineering: E	lective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compuls	•		
	Energy and Environmental Engineering: Core qualification: Core			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation		•	
	General Engineering Science (English program, 7 semester):			/
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Elective 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 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		



Module M0891: Informatics	for Process Engineers			
Courses				
Title		Тур	Hrs/wk	CP
Informatics for Process Engineers (L0836		Lecture	2	2
Informatics for Process Engineers (L0837		Recitation Section (small)	2	2
Numeric and Matlab (L0125)	,	Laboratory Course	2	2
Module Responsible	Dr. Marcus Venzke			
Admission Requirements	None.			
Recommended Previous	Basic knowledge in using MS Windows.			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following I	earning results		
Professional Competence				
Knowledge	Students can describe procedural and object-oriented concepts.			
Personal 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): Specialisation Pr			
Curricula	General Engineering Science (German program, 7 semester): Spec			ompulsory
	General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Electiv	ve Compulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compu			
	General Engineering Science (English program): Specialisation Program			
	General Engineering Science (English program, 7 semester): Spec	ialisation Energy and Enviromental En	gineering: Elective Co	mpulsory
	General Engineering Science (English program, 7 semester): Spec	ialisation Process Engineering: Electiv	e Compulsory	
	Process Engineering: Core qualification: Compulsory			



Course L0836: Informatics for Proc	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	1. Programming in Matlab 2. Numerical methods for systems of nonlinear equations 3. Basics in computer arithmetic 4. Linear and nonlinear optimization 5. Condition of problems and algorithms 6. Verified numerical results with INTLAB
Literature	Literatur (Software-Teil): 1. Moler, C., Numerical Computing with MATLAB, SIAM, 2004 2. The Math Works, Inc., MATLAB: The Language of Technical Computing, 2007 3. Rump, S. M., INTLAB: Interval Labority, http://www.ti3.tu-harburg.de 4. Highham, D. J.; Highham, N. J., MATLAB Guide, SIAM, 2005



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

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



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

G. Kaibel, Dissertation, TU München, 1987
G. Kaibel, 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.I. Lang Chem Eng 55/6) 112 1948

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

Course L0096: Process and Plant E	rse 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 M0829: Foundation		
Courses		
Title	Typ Hrs/wk CP	
Introduction to Management (L0880)	Lecture 3 3	
Project Entrepreneurship (L0882)	Problem-based Learning 2 3	
Module Responsible		
Admission Requirements		
Recommended Previous Knowledge		
Educational Objectives		
Professional Competence		
Knowledge		sation t
Skills	 explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions in field of Management explain the most important aspects of and goals in Management and name the most important aspects of entreprneurial projects describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and ressource management, information management, innovation management and marketing explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives and uncertainty, and some basic methods from mathematical Finance state basics from accounting and costing and selected controlling methods. Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry Entrepreneurship project in a team. In particular, they are able to analyse Management goals and structure them appropriately analyse organisational and staff structures of companies apply methods for decision making under multiple objectives, under uncertainty and under risk analyse and apply basic methods of marketing select and apply basic methods from mathematical finance to predefined problems apply basic methods from accounting, costing and controlling to predefined problems 	d huma
Personal Competence Social Competence		
Autonomy	Students are able to work in a team and to organize the team themselves to write a report on their project.	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70	
Credit points		
Examination		
Examination duration and scale		
Assignment for the Following		
Curricula		
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory	
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory	
	General Engineering Science (German program): Specialisation Energy and Environmental Engineering: Compulsory	
	General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory	
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory	
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Comp	pulso
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science	cience
	Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering	neerin



Compulsory

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

ompulsory

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

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

Energy and Environmental Engineering: Core qualification: Compulsory

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

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

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

 $Technomathematics: Core\ qualification: Compulsory$

Process Engineering: Core qualification: Compulsory



	Lecture
Typ	3
Hrs/wk	
	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga
Lammana	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona DE
Language	
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 opportunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.

Course L0882: Project 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		
Language	DE		
Cycle	WiSe/SoSe		
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,		
	using their knowledge from the corresponding lecture.		
	Project work is carried out in teams with the support of a mentor.		
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.		



Specialization Computer Science

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

Module M0561: Discrete Ale	gebraic Structures			
Courses				
Title		Тур	Hrs/wk	СР
Discrete Algebraic Structures (L0164)		Lecture	2	3
Discrete Algebraic Structures (L0165)		Recitation Section (small)	2	3
Module Responsible	Prof. Karl-Heinz Zimmermann			
Admission Requirements	None.			
Recommended Previous	Mathematics from High School.			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fol	owing learning results		
Professional Competence				
Knowledge	The students know the important basics of discrete algebra	aic structures including elementary combinat	orial structures, mono	ids, groups, rings, fields,
	finite fields, and vector spaces. They also know specific stru	ctures like sub sum-, and quotient structures	and homomorphisms.	
Skills	Students are able to formalize and analyze basic discrete a	gebraic structures.		
Personal Competence				
·	Students are able to solve specific problems alone or in a g	roup and to present the results accordingly		
Codial Competence	cladella die dale la solve spesilie problema dione di ili d g	oup and to present the results assertingly.		
Autonomy	Students are able to acquire new knowledge from specific s	tandard books and to associate the aquired kr	nowledge to other clas	ses.
	Independent Study Time 124, Study Time in Lecture 56			
Credit points				
	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialis			
Curricula	General Engineering Science (German program, 7 semeste	r): Specialisation Computer Science: Computer	sory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program, 7 semeste		sory	
	Computational Science and Engineering: Core qualification			
	Technomathematics: Specialisation I. Mathematics: Elective	Compulsory		

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

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



Courses				
Title		Тур	Hrs/wk	CP
Computer Engineering (L0321) Computer Engineering (L0324)		Lecture Recitation Section (small)	3 1	4
Module Responsible	Prof. Heiko Falk	Ticolation decision (Small)		
Admission Requirements	None			
Recommended Previous	Basic knowledge in electrical engineering			
Knowledge				
	The successful completion of the labs will be honored dur	ring the evaluation of the module's examination acc	cording to the following	ng rules:
	Upon a passed module examination, the studer examination's marks are lifted by 0,3 or 0,4, respective. The improvement of the grade 5,0 up to 4,3 and of	ctively, up to the next-better grade.	ks due to the succes	ssful labs, such that t
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	This module deals with the foundations of the functional gates. The module includes the following topics: • Introduction			el programming down
	Sequential logic: Flip-flops, automata, systematic l Technological foundations Computer arithmetic: Integer addition, subtraction.	, multiplication and division	l networks	
	Basics of computer architecture: Programming mo Memories: Memory hierarchies, SRAM, DRAM, ca Input/output: I/O from the perspective of the CPU, p	aches	ns, busses	
Skills	The students perceive computer systems from the arc computer systems. The students can analyze, how hig components. They are able to distinguish between and to up to complete processors.	hly specific and individual computers can be bu	ilt based on a colle	ction of few and simp
	After successful completion of the module, the students a executed on it. In particular, they shall understand the co the assembly language down to gates. This way, they will performance and to propose feasible options.	onsequences that the execution of software has on	the hardware-centri	c abstraction layers from
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	a literature and to associate this knowledge with of	her classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes, contents of course and labs			
Assignment for the Following	General Engineering Science (German program): Core q	ualification: Compulsory		
Assignment for the Following Curricula	General Engineering Science (German program): Core q General Engineering Science (German program, 7 semes	' '	ry	
0		ster): Specialisation Computer Science: Compulso	•	
0	General Engineering Science (German program, 7 semes	ster): Specialisation Computer Science: Compulsor ster): Specialisation Bioprocess Engineering: Com	pulsory	
0	General Engineering Science (German program, 7 seme: General Engineering Science (German program, 7 seme:	ster): Specialisation Computer Science: Compulsor ster): Specialisation Bioprocess Engineering: Com ster): Specialisation Naval Architecture: Compulsor	pulsory ry	
· ·	General Engineering Science (German program, 7 seme: General Engineering Science (German program, 7 seme: General Engineering Science (German program, 7 seme:	ster): Specialisation Computer Science: Compulsor ster): Specialisation Bioprocess Engineering: Com ster): Specialisation Naval Architecture: Compulsor ster): Specialisation Civil Engineering: Compulsory	pulsory ry	
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· ·	General Engineering Science (German program, 7 seme: General Engineering Science (German program, 7 seme:	ster): Specialisation Computer Science: Compulsor ster): Specialisation Bioprocess Engineering: Compulsor ster): Specialisation Naval Architecture: Compulsor ster): Specialisation Civil Engineering: Compulsory ster): Specialisation Electrical Engineering: Compulsory ster): Specialisation Biomedical Engineering: Compu	pulsory ry / ulsory pulsory	у
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Technomathematics: Specialisation II. Informatics: Elective Compulsory



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

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

Тур	Recitation Section (small)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	
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 shifte
- 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
- 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



ourses				
itle		Тур	Hrs/wk	CP
bjectoriented Programming, Algorithms a		Lecture	4	4
bjectoriented Programming, Algorithms a	and Data Structures (L0132)	Recitation Section (small)	1	2
Module Responsible	Prof. Rolf-Rainer Grigat			
Admission Requirements	None			
Recommended Previous	Lecture Prozedurale Programmierung or equivalent	nt proficiency in imperative programming		
Knowledge	Mandatory prerequisite for this lecture is proficien	cy in imperative programming (C, Pascal, Fortran or s	imilar) You should be	e familiar with simple
		for, while, procedure calls or function calls, pointers, a		
		editor, compiler, linker and debugger. In this lecture v		
	objects and we will not repeat the basics mentione	ed above.		
		LUM because those prerequisites are not part of the c		
	those curricula in general. The programs ET, CT an	nd IIW include those prerequisites in the first semester i	n the lecture Prozedur	ale Programmierung.
Educational Objectives	After taking part successfully, students have reache	ed the following learning results		
Professional Competence				
Knowledge	·	design and the design of a class architecture with r	eference to existing c	lass libraries and de
	patterns.			
	Students can describe fundamental data structures	s of discrete mathematics and assess the complexity of	important algorithms f	or sorting and search
Skills	Students are able to			
	Destinate for a section of a se	and and the description white and a lower white		
		ns and applying class hierarchies and polymorphism		
	Sort and search for data efficiently	using version management systems and Google Test		
	Assess the complexity of algorithms.			
	7 tooose the complexity of algerianne.			
Personal Competence				
Social Competence	Students can work in teams and communicate in fo	orums		
coda, compotence	oladenie dan werk in teame and deminantiale in te	3.4		
Autonomy	Students are able to solve programming tasks suc	ch as LZW data compression using SVN Repository an	d Google Test indene	ndently and over a ne
riationomy	of two to three weeks.	and 2217 data compression using evil repository an	a doogle restinacpe	nacinaly and over a pe
Workload in Hours	Independent Study Time 110, Study Time in Lectur	re 70		_
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 Minutes, Content of Lecture, exercises and mate	erial in StudIP		
Assignment for the Following	General Engineering Science (German program):			
Curricula		7 semester): Specialisation Computer Science: Compu	sorv	
Gariledia	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Computer			
	General Engineering Science (English program): S			
		semester): Specialisation Computer Science: Computer	sory	
	Computational Science and Engineering: Core qua		•	
	Logistics and Mobility: Specialisation Engineering			
	Technomathematics: Core qualification: Compulso			



Course L0131: Objectoriented Programming, Algorithms and Data Structures		
Тур	Lecture	
Hrs/wk		
CP		
Workload in Hours	ependent 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



ourses				
tle		Тур	Hrs/wk	СР
gnals and Systems (L0432)		Lecture	3	4
gnals and Systems (L0433)		Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch			
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge	The modul is an introduction to the theory of signals and syst	ems. Good knowledge in maths as covere	d by the moduls Mat	hematik 1-3 is expe
	Further experience with spectral transformations (Fourier series			
Educational Objectives	After taking part successfully, students have reached the follow	ng learning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and line			
	to apply the fundamental transformations of continuous-time an			
	and systems mathematically in both time and image domain.		in time domain and i	mage domain which
OL III.	caused by the transition of a continuous-time signal to a discret		and the state of the state of	
Skills	The students are able to describe and analyse deterministic si	,	-	
	can analyse and design basic systems regarding important pro- the impact of LTI systems on the signal properties in time and fr		ponse, stability, linear	nty etc They can as
Personal Competence	the impact of E11 systems on the signal properties in time and if	equency domain.		
Social Competence	The students can jointly solve specific problems.			
Autonomy	The students are able to acquire relevant information from ap	propriate literature sources. They can cont	rol their level of know	rledge during the lea
Autonomy	period by solving tutorial problems, software tools, clicker syste		.c. then level of killow	ago during the let
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): Specialisatio	n Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisatio			
	General Engineering Science (German program): Specialisatio			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisatio		mpulsory	
	General Engineering Science (German program): Specialisation	n Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation	n Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester):	Specialisation Electrical Engineering: Comp	oulsory	
	General Engineering Science (German program, 7 semester):	Specialisation Computer Science: Compuls	ory	
	General Engineering Science (German program, 7 semester): 9	Specialisation Process Engineering: Compu	ulsory	
	General Engineering Science (German program, 7 semester): 9	Specialisation Bioprocess Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester): \$			
	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semeste	r): Specialisation Mechanical Engineering	g, Focus Materials ir	Engineering Scier
	Compulsory	Providing tion Machanical Engineering For	vuo Maahatraniaa: Car	maulaan
	General Engineering Science (German program, 7 semester): Science (German program, 7 semester)			
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	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation	n Civil- and Enviromental Engeneering: Cor	mpulsory	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation	n Computer Science: Compulsory		
	General Engineering Science (English program): Specialisation	n Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation	n Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation	Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): S		-	
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	General Engineering Science (English program, 7 semester): S	pecialisation Mechanical Engineering Foo	us Mechatronics: Con	npulsory
	General Engineering Science (English program, 7 semester).			
	Compulsory	, , , , , , , , , , , , , , , , , , ,		
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	Computational Science and Engineering: Core qualification: Co	ompulsory		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

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



Module M0727: Stochastics	S			
Courses				
Title		Тур	Hrs/wk	СР
Stochastics (L0777)		Lecture	2	4
Stochastics (L0778)		Recitation Section (small)	2	2
Module Responsible	Prof. Marko Lindner			
Admission Requirements	none			
Recommended Previous	Calculus			
Knowledge	Discrete algebraic structures (combinatorics)			
	Propositional logic			
	Tropositional logic			
Educational Objectives	After taking part successfully, students have reached the following learning	g results		
Professional Competence				
Knowledge	Students can explain the main definitions of probability, and they ca	n give basic definitions of modeling	g elements (rando	m variables, events,
	dependence, independence assumptions) used in discrete and continuo	ous settings (joint and marginal distrib	utions, density fun	ctions). Students can
	describe characteristic notions such as expected values, variance, star	ndard deviation, and moments. Stude	ents can define de	cision problems and
	explain algorithms for solving these problems (based on the chain rule	or Bayesian networks). Algorithms, o	or estimators as th	ey are caller, can be
	analyzed in terms of notions such as bias of an estimator, etc. Student ca	an describe the main ideas of stochast	tic processes and	explain algorithms for
	solving decision and computation problem for stochastic processes. Stude	·		·
Skills	Students can apply algorithms for solving decision problems, and they	can justify whether approximation to	echniques are goo	d enough in various
	application contexts, i.e., students can derive estimators and judge whethe	er they are applicable or reliable.		
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			
Assignment for the Following	General Engineering Science (German program): Specialisation Compute	r Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Specialisation	on Computer Science: Compulsory		
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Computer	Science: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation	on Computer Science: Compulsory		
	Computational Science and Engineering: Core qualification: Compulsory			
	Logistics and Mobility: Specialisation Engineering Science: Elective Comp	ulsory		



Course L0777: Stochastics	
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Dr. Francisco Javier Hoecker-Escuti
Language	EN
Cycle	SoSe
Content	Foundations of probability theory
	Definitions of probability, conditional probability
	Random variables, dependencies, independence assumptions,
	Marginal and joint probabilities
	Distributions and density functions
	Characteristics: expected values, variance, standard deviation, moments
	Practical representations for joint probabilities
	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
1 Hawatina	
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



Module M0852: Graph Theo	ory and Optimization			
Courses				
Title		Тур	Hrs/wk	СР
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	Discusto Alpahasia Christiana			
Knowledge	Discrete Algebraic Structures Mathematics I			
	• Mathematics I			
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	Objects to the state of the sta	and Outline to The control to the control		
	Students can name the basic concepts in Graph Theory a Students can discuss logical connections between these			
	 Students can discuss logical connections between these They know proof strategies and can reproduce them. 	concepts. They are capable of illustrating	g trese connections wi	in the help of example
	They know proof strategies and carrieproduce trem.			
Skills	Children and an anadal anablassa in County Theory and Ontil		. die die deie ee	
	 Students can model problems in Graph Theory and Option of solving them by applying established methods. 	mization with the help of the concepts sti	idled in this course. Mo	reover, iney are capa
	Students are able to discover and verify further logical co	nnections between the concents studied	in the course	
	For a given problem, the students can develop and execu-	·		sults
Personal Competence Social Competence	Students are able to work together in teams. They are ca In doing so, they can communicate new concepts accord check and deepen the understanding of their peers.			can design example
Autonomy		f according to the large Theory		
	 Students are capable of checking their understanding o where to get help in solving them. 	r complex concepts on their own. They (can specify open quest	ions precisely and Ki
	Students have developed sufficient persistence to be abl	e to work for longer periods in a goal-orie	ented manner on hard p	roblems.
		· · · · · · · ·		
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): S	pecialisation Computer Science: Comput	sory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): Sp		sory	
	Computational Science and Engineering: Core qualification: Cor			
	Logistics and Mobility: Specialisation Engineering Science: Electrical Control of the Property of the Control o			
	Technomathematics: Specialisation I. Mathematics: Elective Cor	iipuisofy		



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

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



Module M0624: Logic, Auto	mata and Formal Languages			
Courses				
Title		Тур	Hrs/wk	CP
Logic, Automata Theory and Formal Lange	Ianes (I 0332)	Lecture	2	4
Logic, Automata Theory and Formal Langi		Recitation Section (small)	2	2
Module Responsible	Prof. Tobias Knopp			
Admission Requirements	None			
Recommended Previous	Participating students should be able to			
Knowledge	- specify algorithms for simple data structures (such as, e.g., ar	rays) to solve computational problems		
	- apply propositional logic and predicate logic for specifying ar	nd understanding mathematical proofs		
	- apply the knowledge and skills taught in the module Discrete	Algebraic Structures		
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results		
Professional Competence				
	Students can show correspondences to Boolean algebra. Sti logic, and therefore, the students can motivate predicate logi Students can explain unification and resolution for solving the decision problems for various kinds of temporal logic, and idea automata and can identify relationships to logic and form nondeterministic finite automata and pushdown automata to expressive than determinism. They are also able to demons transform decision problems w.r.t. one formalism into decision algorithms whereas others are best suited for specifying systems as logic, automata, or grammars.	c, and define syntax, semantics, and decisi- predicate logic SAT decision problem. Stuc- ntify their application areas. The participants al grammars. The spectrum that students Turing machines. Students can name those trate which decision problems require which n problems w.r.t. other formalisms. They un	on problems for this re ents can also describe of the course can defi can explain ranges formalism for which is the expressivity, and, in derstand that some for	epresentation formalism e syntax, semantics, and ne various kinds of finite from deterministic and nondeterminism is more n addition, students car ormalisms easily induce
Skills	Students can apply propositional logic as well as predicate logic derive propositional logic, predicate logic, or temporal logic fo application problem, and they can demonstrate the application nondeterministic automata into deterministic ones, or derive gapply algorithms for the language emptiness problem in case	rmulas to represent them. They can evaluate on of algorithms for decision problems to s grammars from automata and vice versa. Th	e which formalism is be specific formulas. Stud	est suited for a particula ents can also transform
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	on Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semester):	Specialisation Computer Science: Elective 0	Compulsory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation	n Computer Science: Compulsory		
	General Engineering Science (English program, 7 semester):		Compulsory	
	Computational Science and Engineering: Core qualification: C			
	Technomathematics: Specialisation II. Informatics: Elective Co	mpulsory		



Course L0332: Logic, Automata The	eory 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
Content	
	Propositional logic, Boolean algebra, propositional resolution, SAT-2KNF
	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
	provision of a tool which, in some cases, can be used to show that a limite automator principally cannot be expressive enough to solve a word problem for some given language
	10. Regular expressions vs. finite automata:
	Equivalence of formalisms, systematic transformation of representations, reductions
	11. Pushdown automata and context-free grammars:
	Definition of pushdown automata, definition of context-free grammars, derivations, parse trees, ambiguities, pumping lemma for context-free
	grammars, transformation of formalisms (from pushdown automata to context-free grammars and back)
	12. Chomsky normal form
	13. CYK algorithm for deciding the word problem for context-free grammrs
	14. Deterministic pushdown automata
	15. Deterministic vs. nondeterministic pushdown automata:
	Application for parsing, LL(k) or LR(k) grammars and parsers vs. deterministic pushdown automata, compiler compiler
	16. Regular grammars
	17. Outlook: Turing machines and linear bounded automata vs general and context-sensitive grammars
	18. Chomsky hierarchy
	19. Mealy- and Moore automata:
	Automata with output (w/o accepting states), infinite state sequences, automata networks
	20. Omega automata: Automata for infinite input words, Büchi automata, representation of state transition systems, verification w.r.t. temporal logic
	specifications (in particular LTL)
	21. LTL safety conditions and model checking with Büchi automata, relationships between automata and logic
	22. Fixed points, propositional mu-calculus
	23. Characterization of regular languages by monadic second-order logic (MSO)
Literature	A Local Calaterna Charles Only in Order of A fi
	Logik für Informatiker Uwe Schöning, Spektrum, 5. Aufl. Logik für Informatiker Martin Krauger, Staffen Krähling, Beargen Stadium, 2005.
	Logik für Informatiker Martin Kreuzer, Stefan Kühling, Pearson Studium, 2006 Grundkurs Theoretische Informatik, Gottfried Vossen, Kurt-Ulrich Witt, Vieweg-Verlag, 2010.
	Grundkurs Theoretische Informatik, Gottined Vossen, Kurt-Offich Wilt, Vieweg-Verlag, 2010. Principles of Model Checking, Christel Baier, Joost-Pieter Katoen, The MIT Press, 2007.
	4. Thirdpied of model officiality, official ballet, obtact fellet fiducity file Will Fiess, 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 M0803: Embedded	Systems			
Courses				
Title		Тур	Hrs/wk	СР
Embedded Systems (L0805)		Lecture	3	4
Embedded Systems (L0806)		Recitation Section (small)	1	2
Module Responsible	Prof. Heiko Falk			
Admission Requirements	None			
Recommended Previous	Computer Engineering			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	Embedded systems can be defined as information processing sys	stems embedded into enclosing produc	cts. This course teache	s the foundations of such
	systems. In particular, it deals with an introduction into these sys	stems (notions, common characteristics	s) and their specification	on languages (models of
	computation, hierarchical automata, specification of distributed	systems, task graphs, specification of	of real-time application	ns, translations between
	different models).			
	Another part covers the hardware of embedded systems: Sonso	ors A/D and D/A converters real-time	canable communicati	on hardware embedded
	processors, memories, energy dissipation, reconfigurable logic at		•	
	middleware and real-time scheduling. Finally, the implementa			
	partitioning, high-level transformations of specifications, energy-e	•		• .
Skilla	After having attended the course, students shall be able to re-	aliza aimple ambaddad ayatama. Tha	atudanta aball raaliza	which relevant parts of
Skills	technological competences to use in order to obtain a functional			•
	computations and feasible techniques for system-level design. T	•	•	•
	exist.	mey shall be able to judge in which al	reas or embedded sys	terri desigri specific risks
Personal Competence	CAISE.			
Social Competence	Students are able to solve similar problems alone or in a group ar	nd to present the results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific literature	re and to associate this knowledge with	other classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes, contents of course and labs			
Assignment for the Following	General Engineering Science (German program, 7 semester): Spo	ecialisation Computer Science: Elective	Compulsory	
Curricula	Computer Science: Specialisation Computer and Software Engine	eering: Elective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program, 7 semester): Spe	ecialisation Computer Science: Elective	Compulsory	
	Computational Science and Engineering: Core qualification: Com	pulsory		
	Mechatronics: Specialisation System Design: Elective Compulsor	у		
	Mechatronics: Specialisation Intelligent Systems and Robotics: Ele	ective Compulsory		

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



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



odule M0662: Numerical I	Mathematics I			
ourses				
le		Тур	Hrs/wk	СР
merical Mathematics I (L0417)		Lecture	2	3
merical 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 of basic MATLAB knowledge)	or english) or Analysis & Linear Algebra I + II fo	r Technomathematicia	ans
Educational Objectives	After taking part successfully, students have reached the fol	lowing learning results		
Professional Competence				
Knowledge	Students are able to			
	name numerical methods for interpolation, integral explain their core ideas, repeat convergence statements for the numerical methods explain aspects for the practical execution of numerical explain aspects.	ethods,		finding problems an
Skills	Students are able to			
	implement, apply and compare numerical methods to justify the convergence behaviour of numerical methods to select and execute a suitable solution approach for the select and execute as a suitable solution.	nods with respect to the problem and solution al	lgorithm,	
Personal Competence				
Social Competence	Students are able to			
Autonomy	work together in heterogeneously composed teams foundations and support each other with practical as Students are capable			dge), explain theore
	to assess whether the supporting theoretical and pra to assess their individual progess and, if necessary,		or in a team,	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialis	ation Computer Science: Compulsory		
Curricula	General Engineering Science (German program): Specialis		anics: Compulsory	
	General Engineering Science (German program): Specialis			ices: Compulsory
	General Engineering Science (German program): Specialis		0 0	, ,
	General Engineering Science (German program, 7 semeste	er): Specialisation Computer Science: Compuls	ory	
	General Engineering Science (German program, 7 semi	ester): Specialisation Mechanical Engineering	g, Focus Materials in	Engineering Scien
	Compulsory			
	General Engineering Science (German program, 7 semeste	er): Specialisation Biomedical Engineering: Cor	mpulsory	
	General Engineering Science (German program, 7 semeste		cus Biomechanics: Co	mpulsory
	Bioprocess Engineering: Specialisation A - General Bioproc	0 0 ,		
	Computer Science: Specialisation Computational Mathema			
	Electrical Engineering: Core qualification: Elective Compuls General Engineering Science (English program): Specialisa	•		
	General Engineering Science (English program): Specialisa	' ' '		
	General Engineering Science (English program): Specialisa		anics: Compulsory	
	General Engineering Science (English program): Specialisa			ces: Compulsory
	General Engineering Science (English program, 7 semeste	•		1
	General Engineering Science (English program, 7 seme		•	Engineering Scien
	Compulsory			
	General Engineering Science (English program, 7 semeste	r): Specialisation Biomedical Engineering: Con	npulsory	
	General Engineering Science (English program, 7 semeste		us Biomechanics: Cor	mpulsory
	Computational Science and Engineering: Core qualification	, ,		
	General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 semeste General Engineering Science (English program, 7 semeste	ester): Specialisation Mechanical Engineering r): Specialisation Biomedical Engineering: Com r): Specialisation Mechanical Engineering, Foc r: Compulsory	g, Focus Materials in	

Process Engineering: Specialisation Process Engineering: Elective 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
Language	DE
Cycle	WiSe
Content	 Error analysis: Number representation, error types, conditioning and stability Interpolation: polynomial and spline interpolation Numerical integration and differentiation: order, Newton-Cotes formula, error estimates, Gaussian quadrature, adaptive quadrature, difference formulas Linear systems: LU and Cholesky factorization, matrix norms, conditioning Linear least squares problems: normal equations, Gram.Schmidt and Householder orthogonalization, singular value decomposition, regularization Eigenvalue problems: power iteration, inverse iteration, QR algorithm Nonlinear systems of equations: Fixed point iteration, root-finding algorithms for real-valued functions, Newton and Quasi-Newton methods for systems
Literature	Stoer/Bulirsch: Numerische Mathematik 1, Springer Dahmen, Reusken: Numerik für Ingenieure und Naturwissenschaftler, Springer

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



Module M0793: Seminars C	computer Science and Mathematics			
Courses				
Title		Тур	Hrs/wk	СР
Seminar Computational Mathematics/Com	puter Science (L0797)	Seminar	2	2
Seminar Computational Engineering Science	ce (L0796)	Seminar	2	2
Seminar Engineering Mathematics/Compu	ter Science (L1781)	Seminar	2	2
Module Responsible	Prof. Karl-Heinz Zimmermann			
Admission Requirements	None			
Recommended Previous	Basic knowledge in Computer Science, Mathematics, an	d 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, Mat	thematics, or Engineering S	cience.
Skills	The students are able to elaborate self-reliantly a rudimentary subfield of Computer Science, Mathematics, or Engineering Science.			
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Presentation			
Examination duration and scale	Pro Seminar erfolgt der Scheinerwerb durch Präsentatio	n (Seminarvortrag 25 min und Diskussion 5	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: Co	mpulsory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specia	lisation Computer Science: Compulsory		
	General Engineering Science (English program, 7 seme	ster): Specialisation Computer Science: Cor	mpulsory	
	Computational Science and Engineering: Core qualificat	tion: Compulsory		

Course I 0797: Seminar Computation	anal Mathematics/Computer Science	
Course 20191. Gennial Computation	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	
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 Computation	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
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		Lecture	3	5
Computer Networks and Internet Security		Recitation Section (small)	1	I
	Prof. Andreas Timm-Giel			
Admission Requirements	None			
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	ne following learning results		
Professional Competence				
Knowledge	Students are able to explain important and common Ir	ternet protocols in detail and classify them, in or	der to be able to analyse	e and develop networked
	systems in further studies and job.			
Skills	Students are able to analyse common Internet protocols and evaluate the use of them in different domains.			
Personal Competence				
Social Competence				
Autonomy	Students can select relevant parts out of high amount of	of professional knowledge and can independent	v learn and understand it	t.
			,	-
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	3		
Credit points	6			
Examination	Written exam			
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): Spe	cialisation Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 ser	nester): Specialisation Computer Science: Election	ve Compulsory	
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Elective Cor	npulsory		
	General Engineering Science (English program): Spec	cialisation Computer Science: Compulsory		
	General Engineering Science (English program, 7 sen	nester): Specialisation Computer Science: Electiv	e Compulsory	
	Computational Science and Engineering: Core qualific	eation: Compulsory		
	Technomathematics: Specialisation II. Informatics: Elec	ctive Compulsory		
	Technomathematics: Specialisation II. Informatics: Elec	ctive Compulsory		

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



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



Module M0731: Functional	Programming			
Courses				
Title		Тур	Hrs/wk	СР
Functional Programming (L0624)		Lecture	2	2
Functional Programming (L0625)		Recitation Section (large)	2	2
Functional Programming (L0626)		Recitation Section (small)	2	2
Module Responsible	Prof. Sibylle Schupp			
Admission Requirements	None			
Recommended Previous	Discrete mathematics at high-school level			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	Students apply the principles, constructs, and simple design techniques of functional programming. They demonstrate their ability to read Haske programs and to explain Haskell syntax as well as Haskell's read-eval-print loop. They interpret warnings and find errors in programs. They apply th fundamental data structures, data types, and type constructors. They employ strategies for unit tests of functions and simple proof techniques for partial and total correctness. They distinguish laziness from other evaluation strategies.			
Skills	Students break a natural-language description down in parts amenable to a formal specification and develop a functional program in a structured way They assess different language constructs, make conscious selections both at specification and implementations level, and justify their choice. They analyze given programs and rewrite them in a controlled way. They design and implement unit tests and can assess the quality of their tests. They argue for the correctness of their program.			
Personal Competence				
Social Competence	Students practice peer programming with varying peers. They excommunicate in English.	xplain problems and solutions to their I	peer. They defend the	eir programs orally. They
Autonomy	In programming labs, students learn under supervision (a.k.a. "Betreutes Programmieren") the mechanics of programming. In exercises, they develop solutions individually and independently, and receive feedback.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation C	Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Spe	cialisation Computer Science: Elective	Compulsory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Co	omputer Science: Compulsory		
	General Engineering Science (English program, 7 semester): Spec	cialisation Computer Science: Elective C	Compulsory	
	Technomathematics: Specialisation II. Informatics: Elective Compu	llsory		

Course L0624: Functional Programm	ming
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 Programm	Course L0625: Functional Programming		
Тур	Recitation Section (large)		
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.		

Course L0626: Functional Programming		
Тур	Recitation Section (small)	
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	See interlocking course	
Literature	See interlocking course	



Module M0791: Computer A	Architecture				
0					
Courses					
Title		Тур	Hrs/wk	CP	
Computer Architecture (L0793)		Lecture	2	4	
Computer Architecture (L0794)		Recitation Section (small)	2	2	
Module Responsible	Prof. Heiko Falk				
Admission Requirements	None				
Recommended Previous	Module "Computer Engineering"				
Knowledge	The successful completion of the labs will be honored during the e	valuation of the module's examination a	according to the following	ng rules:	
	Upon a passed module examination, the student is gran	ted a honus on the examination's ma	arks due to the succes	esful lahs such that the	
	examination's marks are lifted by 0,3 or 0,4, respectively, up		and dde to the bucce	iolar labo, odorr triat tric	
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to	*			
	2. The improvement of the grade 0,0 ap to 4,0 and of 4,0 ap to	T, o to thet possible.			
Educational Objectives	After taking part successfully, students have reached the following	learning results			
Professional Competence					
Knowledge	This module presents advanced concepts from the discipline of o	omputer architecture. In the beginning	, a broad overview ov	er various programming	
	models is given, both for general-purpose computers and for special-purpose machines (e.g., signal processors). Next, foundational aspects of			ndational aspects of the	
	micro-architecture of processors are covered. Here, the focus par	icularly lies on the so-called pipelining	and the methods use	d for the acceleration of	
	instruction execution used in this context. The students get to k	now concepts for dynamic scheduling	, branch prediction, s	uperscalar execution of	
	machine instructions and for memory hierarchies.				
Skills	The students are able to describe the organization of processors. T	hey know the different architectural pri	nciples and programmi	na models. The students	
		·		-	
	examine various structures of pipelined processor architectures and are able to explain their concepts and to analyze them w.r.t. criteria like, e.g., performance or energy efficiency. They evaluate different structures of memory hierarchies, know parallel computer architectures and are able to				
	distinguish between instruction- and data-level parallelism.				
Personal Competence					
Social Competence	Students are able to solve similar problems alone or in a group and	d to present the results accordingly.			
Autonomy	Students are able to acquire new knowledge from specific literature	e and to associate this knowledge with	other classes.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56				
Credit points	6				
Examination	Written exam				
Examination duration and scale	90 minutes, contents of course and 4 lab attestations				
Assignment for the Following	General Engineering Science (German program): Specialisation C	omputor Scionco: Compulsory			
Curricula	General Engineering Science (German program, 7 semester): Spe		Compulsory		
Curricula	Computer Science: Specialisation Computer and Software Engine		Compulsory		
	General Engineering Science (English program): Specialisation Computer and Soliware Engine				
			Compulsory		
	General Engineering Science (English program, 7 semester): Spec	·	Jonipulsory		
	Computational Science and Engineering: Specialisation Computer	Science. Elective Compulsory			

Course L0793: Computer Architectu	ure		
Тур	ture		
Hrs/wk	2		
CP	4		
Workload in Hours	Independent Study Time 92, 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 		
Literature	 D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. 		



Course L0794: Computer Architect	course L0794: Computer Architecture	
Тур	Recitation Section (small)	
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	siehe korrespondierende Lehrveranstaltung	
	see interlocking course	



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



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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

Process Engineering: Core qualification: Compulsory

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



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



	ns of Management			
urses				
е		Тур	Hrs/wk	CP
oduction to Management (L0880)		Lecture	3	3
ject Entrepreneurship (L0882)		Problem-based Learning	2	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	After taking this module, students know the important basics o Marketing and Innovation, and also to Investment and Controlling		anagement, from Planr	ning and Organisation
	explain the differences between Economics and Manag	sement and the sub-disciplines in Manager	nent and to name imp	ortant definitions from
	field of Management	ement and the sub-disciplines in Manageri	ient and to name impo	ortani delimbons bom
	explain the most important aspects of and goals in Mana	agement and name the most important asp	ects of entreprneurial r	orojects
	describe and explain basic business functions as proc			
	ressource management, information management, inno		, ·	
	explain the relevance of planning and decision makin		ultiple objectives and	uncertainty, and expl
	some basic methods from mathematical Finance		, ,	,
	state basics from accounting and costing and selected of	controlling methods.		
Skills	Students are able to analyse business units with respect Entrepreneurship project in a team. In particular, they are able to		ctives, strategies etc	.) and to carry out
	Entrepreneurship project in a team. In particular, they are able to	0		
	analyse Management goals and structure them appropr	iately		
	analyse organisational and staff structures of companies	3		
	apply methods for decision making under multiple object	tives, under uncertainty and under risk		
	analyse production and procurement systems and Busin	ness information systems		
	analyse and apply basic methods of marketing			
	select and apply basic methods from mathematical finar			
	 apply basic methods from accounting, costing and contr 	olling 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 entrepret	neurship 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			
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	work in a team and to organize the team themselves			
	to write a report on their project.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
	, , ,			
Credit points				
Examination				
Examination duration and scale				
Assignment for the Following				
Curricula				
	General Engineering Science (German program): Specialisatio			
	General Engineering Science (German program): Specialisatio			
	General Engineering Science (German program): Specialisatio	•		
	General Engineering Science (German program): Specialisatio		mpulsory	
	General Engineering Science (German program): Specialisatio			
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	General Engineering Science (German program): Specialisatio		ouloon.	
	General Engineering Science (German program, 7 semester): S		•	
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	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester): S		•	
	0	specialisation Energy and Enviromental En	gineering: Compulsor	У
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S	Specialisation Mechanical Engineering, Foo	cus Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S	Specialisation Mechanical Engineering, Foo Specialisation Mechanical Engineering, Foo	cus Biomechanics: Co cus Aircraft Systems E	mpulsory ngineering: Compuls
	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)	Specialisation Mechanical Engineering, Foo Specialisation Mechanical Engineering, Foo	cus Biomechanics: Co cus Aircraft Systems E	mpulsory ngineering: Compulso
	General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S	Specialisation Mechanical Engineering, Foo Specialisation Mechanical Engineering, Foo pr): Specialisation Mechanical Engineerin	cus Biomechanics: Co cus Aircraft Systems E g, Focus Materials in	mpulsory ngineering: Compulso n Engineering Science



Compulsory

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

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

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

Energy and Environmental Engineering: Core qualification: Compulsory

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

Mechanical Engineering: Core qualification: Compulsory

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

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



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

Course L0882: Project Entrepreneurship		
Тур	Problem-based Learning	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Christoph Ihl	
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 M1269: Lab Cyber-	Physical Systems
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Courses	Tue Heatel OD
Title Lab Cyber-Physical Systems (L1740)	Typ Hrs/wk CP Problem-based Learning 4 6
Module Responsible	Prof. Heiko Falk
Admission Requirements	None
Recommended Previous	Module "Embedded Systems"
Knowledge	Iniodule Ellibedded Systems
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	The lating part decession, state in the recent of the following reading
Knowledge	Cyber-Physical Systems (CPS) are tightly integrated with their surrounding environment, via sensors, A/D and D/A converters, and actors. Due to thei particular application areas, highly specialized sensors, processors and actors are common. Accordingly, there is a large variety of different specification approaches for CPS - in contrast to classical software engineering approaches.
	Based on practical experiments using robot kits and computers, the basics of specification and modelling of CPS are taught. The lab introduces into the area (basic notions, characteristical properties) and their specification techniques (models of computation, hierarchical automata, data flow models, petr nets, imperative approaches). Since CPS frequently perform control tasks, the lab's experiments will base on simple control applications. The experiments will use state-of-the-art industrial specification tools (MATLAB/Simulink, LabVIEW, NXC) in order to model cyber-physical models that interact with the environment via sensors and actors.
Skills	After successful attendance of the lab, students are able to develop simple CPS. They understand the interdependencies between a CPS and its surrounding processes which stem from the fact that a CPS interacts with the environment via sensors, A/D converters, digital processors, D/A converters and actors. The lab enables students to compare modelling approaches, to evaluate their advantages and limitations, and to decide which technique to use for a concrete task. They will be able to apply these techniques to practical problems. They obtain first experiences in hardware-related software development, in industry-relevant specification tools and in the area of simple control applications.
Personal Competence	
Social Competence	Students are able to solve similar problems alone or in a group and to present the results accordingly.
Autonomy	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Examination	Project
Examination duration and scale	Execution and documentation of all lab experiments
Assignment for the Following	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Elective Compulsory
Curricula	Computer Science: Specialisation Computer and Software Engineering: Elective Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Elective Compulsory
	Computational Science and Engineering: Specialisation Computer Science: Elective Compulsory
	Mechatronics: Specialisation Intelligent Systems and Robotics: Elective Compulsory
	Mechatronics: Specialisation System Design: Elective Compulsory

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



Module M0562: Computabi	lity and Complexity Theory			
Courses				
Title		Тур	Hrs/wk	СР
Computability and Complexity Theory (L01	166)	Lecture	2	3
Computability and Complexity Theory (L01	167)	Recitation Section (small)	2	3
Module Responsible	Prof. Karl-Heinz Zimmermann			
Admission Requirements	None.			
Recommended Previous	Discrete Algebraic Structures, Automata Theory, Logic, an	d Formal Language Theory.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fo	ollowing learning results		
Professional Competence				
Knowledge	The students known the important machine models of con	nputability, the class of partial recursive function	s, universal computat	bility, Gödel numbering of
	computations, the theorems of Kleene, Rice, and Rice-Shapiro, the concept of decidable and undecidable sets, the word problems for semi-Thue			
	systems, Thue systems, semi-groups, and Post correspendence systems, Hilbert's 10-th problem, and the basic conecpts of complexity theory.			
Skills	Students are able to investigate the computability of sets and functions and to analyze the complexity of computable functions.			
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 newer literature and to associate the aquired knowledge with other classes.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Oral exam			
Examination duration and scale	Einzelprüfung, 20 min			
Assignment for the Following	General Engineering Science (German program, 7 semes	ter): Specialisation Computer Science: Elective	Compulsory	
Curricula	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program, 7 semest	er): Specialisation Computer Science: Elective C	Compulsory	
	Technomathematics: Specialisation II. Informatics: Elective	Compulsory		
	Technomathematics: Core qualification: Elective Compuls	ory		

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

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



Madula M1000, Mathamatic	al Cintintia			
Module M1062: Mathematic	ai Statistics			
Courses				
Title		Тур	Hrs/wk	СР
Mathematical Statistics (L1339)		Lecture	3	4
Mathematical Statistics (L1340)		Recitation Section (small)	1	2
Module Responsible	Prof. Anusch Taraz			
Admission Requirements	none			
Recommended Previous	Mathematical Stochastics			
Knowledge	Measure Theory and Stochastics			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	Chydonia can name the basic concents in Mathematical Cta	tiation. They are able to explain them us	ina annranriata ayamı	alon
	Students can name the basic concepts in Mathematical Sta Students can discuss logical connections between these or			
	They know proof strategies and can reproduce them.	oncepts. They are capable of mustrating	illese connections wi	ur the help of examples.
	They know proof stategies and san reproduce them.			
Skills				
O.I.III	Students can model problems in Mathematical Statistics	with the help of the concepts studied	in this course. Moreo	ver, they are capable of
	solving them by applying established methods.			
	Students are able to discover and verify further logical conn	·		
	For a given problem, the students can develop and execute	a suitable approach, and are able to c	ritically evaluate the re	sults.
Personal Competence				
Social Competence	 Students are able to work together in teams. They are capa 	ble to use mathematics as a common la	inguage.	
	 In doing so, they can communicate new concepts according 			can design examples to
	check and deepen the understanding of their peers.	, ,		
Autonomy				
	Students are capable of checking their understanding of c	omplex concepts on their own. They c	an specify open quest	ions precisely and know
	where to get help in solving them.	a made faul au annual de de la constitución de la c	ata di manuari e e e e e e	
	Students have developed sufficient persistence to be able to	o work for longer periods in a goal-orie	ntea manner on hard p	propiems.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following	General Engineering Science (German program, 7 semester): Spe	cialisation Computer Science: Elective	Compulsorv	
Curricula	Computer Science: Specialisation Computational Mathematics: Ele		pa.oo. j	
	General Engineering Science (English program, 7 semester): Spec		Compulsory	
	Computational Science and Engineering: Specialisation Compute			
	Technomathematics: Specialisation I. Mathematics: Elective Comp	• •		
	,	· ·		

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



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



Module M0732: Software E	nginooring			
wodule wo732: Software E	ngineering			
Courses				
Title		Тур	Hrs/wk	CP
Software Engineering (L0627)		Lecture	2	3
Software Engineering (L0628)		Recitation Section (small)	2	3
Module Responsible	Prof. Sibylle Schupp			
Admission Requirements	None			
Recommended Previous	A decrease the control formal language			
Knowledge	Automata theory and formal languages			
	Procedural programming or Functional Pr	*		
	Object-oriented programming, algorithms, an	nd data structures		
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	Students explain the phases of the software life cycl	le, describe the fundamental terminology and concep	ts of software enginee	ring, and paraphrase th
	principles of structured software development. They give examples of software-engineering tasks of existing large-scale systems. They write test cases			
	for different test strategies and devise specifications or models using different notations, and critique both. They explain simple design patterns and the			
	major activities in requirements analysis, maintenan	ce, and project planning.		
Skilla	For a given took in the authors life evels studen	sta identify the corresponding phase and calcut on	appropriate method	Thou shoose the prop
Skills	Skills For a given task in the software life cycle, students identify the corresponding phase and select an appropriate method. They choose the approach for quality assurance. They design tests for realistic systems, assess the quality of the tests, and find errors at different levels. They app			
	modify non-executable artifacts. They integrate components based on interface specifications.			in levels. They apply at
	modify non-executable artifacts. They integrate com	porients based on interface specifications.		
Personal Competence				
Social Competence	Students practice peer programming. They explain problems and solutions to their peer. They communicate in English.			
Autonomy	Heing on line quizzes and accompanying material t	for self study, students can assess their level of know	ladge continuously an	d adjust it appropriately
Autonomy	Working on exercise problems, they receive addition	•	ledge continuously an	id adjust it appropriater
	working on exercise problems, they receive addition	iai leeuback.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture	56		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program, 7 s	semester): Specialisation Computer Science: Elective	Compulsory	
Curricula	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program, 7 s	emester): Specialisation Computer Science: Elective (Compulsory	
	Computational Science and Engineering: Specialisa	ation Computer Science: Elective Compulsory		
	Computational Science and Engineering: Specialisa	ation Computer Science: Elective Compulsory		
	Technomathematics: Specialisation II. Informatics: E	lective Compulsory		

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

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



Module M0971: Operating S	Systems			
Courses				
			Here fords	0.0
Title		Тур	Hrs/wk 2	CP 3
Operating Systems (L1153) Operating Systems (L1154)		Lecture Recitation Section (small)	2	3
Module Responsible	Prof. Volker Turau	resident section (small)		-
Admission Requirements	None			
Recommended Previous	Notice			
Knowledge	 Object-oriented programming, algorithms, and data structure 	tures		
Knowledge	 Procedural programming 			
	 Experience in using tools related to operating systems s 	uch as editors, linkers, compilers		
	Experience in using C-libraries			
Educational Objectives	After taking part successfully, students have reached the followi	ng learning results		
Professional Competence				
Knowledge	Students explain the main abstractions process, virtual memory, deadlock, lifelock, and file of operations systems, describe the process states and their			
	transitions, and paraphrase the architectural variants of operating systems. They give examples of existing operating systems and explain their			
	architectures. The participants of the course write concurrent programs using threads, conditional variables and semaphores. Students can describe the			
	variants of realizing a file system. Students explain at least three different scheduling algorithms.			
Skills	Students are able to use the BOSIV libraries for consurrent	vegramming in a correct and officient we	Thou are able to	iudgo the officionay of a
Skills	s Students are able to use the POSIX libraries for concurrent programming in a correct and efficient way. They are able to judge the efficiency of a scheduling algorithm for a given scheduling task in a given environment.			
	solicating algorithm for a given solicating task in a given envi	omicit.		
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): S	pecialisation Computer Science: Elective	Compulsory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): S		Compulsory	
	Computational Science and Engineering: Specialisation Compu			
	Technomathematics: Specialisation II. Informatics: Elective Com	pulsory		

Course L1153: Operating Systems	
Тур	Lecture
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	 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



Specialization Mechanical Engineering

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

Graduates have:

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

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

Module M0598: Mechanical	Engineering: Design			
courses				
itle		Тур	Hrs/wk	СР
mbodiment Design and 3D-CAD (L0268)		Lecture	2	1
- : :			3	2
lechanical Design Project I (L0695)		Practical Course		
lechanical Design Project II (L0592)	a).	Practical Course	3	2
eam Project Design Methodology (L0267)	Problem-based Learning	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	Fundamentals of Mechanical Engineering Design			
Knowledge	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	explain design guidelines for machinery parts e.g. consi	dering load situation, materials and manufa	acturing requirements,	
	 describe basics of 3D CAD, 			
	 explain basics methods of engineering designing. 			
Skills	After passing the module, students are able to:			
	independently create sketches, technical drawings and	documentations e.g. using 3D CAD,		
	 design components based on design guidelines autono 	mously,		
	 dimension (calculate) used components, 			
	 use methods to design and solve engineering design ta 	sks systamtically and solution-oriented.		
	apply creativity techniques in teams.	, ,		
	- apply oreality confides in leans.			
Personal Competence				
Social Competence	After passing the module, students are able to:			
	 develop and evaluate solutions in groups including maken 	ing and documenting decicions		
		and documenting decisions,		
	moderate the use of scientific methods,			
	 present and discuss solutions and technical drawings w 	ithin groups,		
	reflect the own results in the work groups of the course.			
Autonomy	Students are able			
,				
	to estimate their level of knowledge using activating me	ethods within the lectures (e.g. with clickers)	,	
	To solve engineering design tasks systematically.			
Workload in Hours	Independent Study Time 40, Study Time in Lecture 140			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180			
Assignment for the Following	General Engineering Science (German program): Specialisatio	n Energy and Enviromental Engineering: C	ompulsory	
Curricula	General Engineering Science (German program): Specialisatio	n Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisatio	n Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): 9		mpulsory	
	General Engineering Science (German program, 7 semester): §			
	General Engineering Science (German program, 7 semester): S		gineering: Compulsory	
	Energy and Environmental Engineering: Core qualification: Cor	•		
	General Engineering Science (English program): Specialisation	n Energy and Enviromental Engineering: Co	ompulsory	
		Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation	r weenamear Engineering. Compaisory		
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	Biomedical Engineering: Compulsory	npulsorv	
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): S	n Biomedical Engineering: Compulsory pecialisation Mechanical Engineering: Com		
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S	n Biomedical Engineering: Compulsory pecialisation Mechanical Engineering: Con pecialisation Biomedical Engineering: Com	npulsory	
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S	n Biomedical Engineering: Compulsory pecialisation Mechanical Engineering: Con pecialisation Biomedical Engineering: Com	npulsory	
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S	n Biomedical Engineering: Compulsory pecialisation Mechanical Engineering: Con pecialisation Biomedical Engineering: Com	npulsory	



Naval Architecture: Core qualification: Compulsory

Lecturer Prof. Dieter Krause Language DE Cycle WiSe Content Basics of 3I Practical co Intro Skei Crea Deri	Time 2, Study Time in Lecture 28
CP 1 Workload in Hours Independent Study Lecturer Prof. Dieter Krause Language DE Cycle WiSe Content Basics of 30 Practical co Intro Sket Crea Deri	
Workload in Hours Independent Study Lecturer Prof. Dieter Krause Language DE Cycle WiSe Content • Basics of 3I • Practical co • Intro • Sket • Crea • Deri	
Lecturer Prof. Dieter Krause Language DE Cycle WiSe Content Basics of 3[Practical co Intro Sket Crea Deri	
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Content Basics of 3I Practical co Intro Sket Cre Deri	
Basics of 3I Practical co Intro Sket Crec Deri Literature	
Handbuch I Dubbel, Tag Technische Maschinene Maschinene Konstruktion	O CAD technology urse to apply a 3D CAD system iduction to the system teching and creation of components ation of assemblies ving technical drawings enieure eine praxisbezogene Einführung; Vajna, S., Weber, C., Bley, H., Zeman, K.; Springer-Verlag, aktuelle Auflage. Konstruktion; Rieg, F., Steinhilper, R.; Hanser; aktuelle Auflage. schenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. s Zeichnen: Grundlagen, Normen, Beispiele, Darstellende Geometrie, Hoischen, H; Hesser, W; Cornelsen, aktuelle Auflage. elemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage. und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. nslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. elemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.

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



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

Course L0267: Team Project Design	n Methodology
Тур	Problem-based Learning
Hrs/wk	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 M0933: Fundamen	tals of Materials Science			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Materials Science I (L10	35) ranced Ceramic Materials, Polymers and Composites) (L0506)	Lecture Lecture	2	2
Physical and Chemical Basics of Materials		Lecture	2	2
	Prof. Jörg Weißmüller			_
Admission Requirements	None			
Recommended Previous	Highschool-level physics, chemistry und mathematics			
Knowledge	3 · · · · · · · · · · · · · · · · · · ·			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The students have acquired a fundamental knowledge on m	etals, ceramics and polymers a	nd can describe this know	rledge comprehensivel
Ü	Fundamental knowledge here means specifically the issues of a			
	mechanical properties. The students know about the key aspec	ts of characterization methods for	materials and can identify	relevant approaches for
	characterizing specific properties. They are able to trace materials	phenomena back to the underlyin	ng physical and chemical lav	vs of nature.
Chille			llanna of matrice Materials w	h
SKIIIS	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 to can account for the impact of microstructure on the material's behavior.		onditions and the materials	microstructure, and th
	can account for the impact of finctostructure on the material's bene	avioi.		
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			
		Tanana and Farinanantal Farinas		
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation B			
Curricula	General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation I			
	General Engineering Science (German program): Specialisation N		ory	
	General Engineering Science (German program, 7 semester): Spe		na: Compulsory	
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): Spe	-		
	General Engineering Science (German program, 7 semester): Spe			γ
	Energy and Environmental Engineering: Core qualification: Comp			
	General Engineering Science (English program): Specialisation E	nergy and Enviromental Engineer	ing: Compulsory	
	General Engineering Science (English program): Specialisation M	lechanical Engineering: Compulso	ory	
	General Engineering Science (English program): Specialisation B	iomedical Engineering: Compulso	ory	
	General Engineering Science (English program): Specialisation N	laval Architecture: Compulsory		
	General Engineering Science (English program, 7 semester): Spe	cialisation Mechanical Engineerin	g: Compulsory	
	General Engineering Science (English program, 7 semester): Spe	cialisation Biomedical Engineering	g: Compulsory	
	General Engineering Science (English program, 7 semester): Spe	cialisation Naval Architecture: Cor	mpulsory	
	General Engineering Science (English program, 7 semester): Spe	cialisation Energy and Enviromen	tal Engineering: Compulsor	у
	Logistics and Mobility: Specialisation Engineering Science: Elective	ve Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Elec			

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



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

Course L1095: Physical and Chemic	ral Rasirs of Materials Science
,	Lecture
Hrs/wk	
CP	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Müller
Language	DE
Cycle	
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 M0680: Fluid Dynar	nice			
iniodule iniodou. Fluid Dyllai	ilics			
Courses				
Title		Тур	Hrs/wk	СР
Fluid Mechanics (L0454)		Lecture	3	4
Fluid Mechanics (L0455)		Recitation Section (large)	2	2
Module Responsible	Prof. Thomas Rung			
Admission Requirements	none			
Recommended Previous	Sound knowledge of engineering mathematics, engineering me	chanics and thermodynamics.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	Students will have the required sound knowledge to explain th	e general principles of fluid engineering an	d physics of fluids.	Students can scientificall
	outline the rationale of flow physics using mathematical model	s and are familiar with methods for the per	formance analysis a	and the prediciton of fluid
	engineering devices.			
Skills	Students are able to apply fluid-engineering principles and flow	-physics models for the analysis of technics	al evetame. The lecti	ire anables the student to
OKIIIS	carry out all necessary theoretical calculations for the fluid dyna			ire enables the student to
	carry car an incooccary anonouscal canonication on the maid aying	o doorg or origin coming do video on a con-		
Personal Competence				
Social Competence	The students are able to discuss problems and jointly develop s	olution strategies.		
Autonomy	The students are able to develop solution strategies for complex	problems self-consistent and crtically analy	se results.	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	n Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	n Biomedical Engineering: Compulsory		
	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		ry	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation	• •	nulcon	
	General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S	* *		
	General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S		-	
	Computational Science and Engineering: Specialisation Engine		у	
	Mechanical Engineering: Core qualification: Compulsory	Compulsory		
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: El	ective Compulsory		
	and the state of t			

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	o 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 Mechai	ics, Multibody Systems)		
Courses				
Title		Тур	Hrs/wk	СР
Mechanics IV (Kinetics II, Oscillations, Ana	alytical Mechanics, Multibody Systems) (L1137)	Lecture	3	3
Mechanics IV (Kinetics II, Oscillations, Ana	alytical Mechanics, Multibody Systems) (L1138)	Recitation Section (small)	2	2
Mechanics IV (Kinetics II, Oscillations, Ana	alytical Mechanics, Multibody Systems) (L1139)	Recitation Section (large)	1	1
Module Responsible	Prof. Robert Seifried			
Admission Requirements	none			
Recommended Previous	Mathematics I-III and Mechanics I-III			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follo	ving learning results		
Professional Competence				
Knowledge	The students can			
	describe the axiomatic procedure used in mechanical	contexts;		
	 explain important steps in model design; 			
	 present technical knowledge. 			
Skills	The students can			
	explain the important elements of mathematical / mechanical / mec	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 	l extend them to be applicable to wider proble	em sets.	
Personal Competence				
Social Competence	The students can work in groups and support each other to over	ercome difficulties.		
Autonomy	Students are capable of determining their own strengths and	veaknesses and to organize their time and le	arning based on thos	se.
ricionary	cascine are capable of actoriming aren our exemption and		arming based on aloc	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisat	on Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program, 7 semester)		npulsory	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory			
	General Engineering Science (German program, 7 semester)			
	General Engineering Science (English program): Specialisati		-	
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory			
	General Engineering Science (English program): Specialisation Naval Architecture: Compulsory			
	General Engineering Science (English program). Specialisation Naval Architecture. Somptisory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering: Compulsory			
	General Engineering Science (English program, 7 semester): Specialisation Neorialisation Biomedical Engineering: Compulsory			
	General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory			
	Mechanical Engineering: Core qualification: Compulsory	•		
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science:	Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			
	Theoretical Mechanical Engineering: Technical Complement	ury Course Core Studies: Fleetive Compulsor	.,	

Course L1137: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Lecture	
Hrs/wk	3	
CP	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	- Simple impact problems	
	- Principles of analytical mechanics	
	- Elements of vibration theory	
	- 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 (Kineti	ourse 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 (Kineti	ourse L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Recitation Section (large)		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Prof. Robert Seifried		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		



	ent Technology for Mechanical and Process En				
Courses					
Title		Тур	Hrs/wk	СР	
Practical Course: Measurement and Control	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 engineering	ng			
Knowledge					
Educational Objectives	After taking part successfully, students have reached the following	ng learning results			
Professional Competence					
Knowledge	Students are able to name the most important fundmentals of	the Measurement Technology (Quantities	and Units, Uncertainty	, Calibration, Static a	
	Dynamic Properties of Sensors and Systems).				
	They can outline the most important measuring methods for dif	forant kinds of quantities to be massured	(Floatrical Quantities	Fomporaturo mochani	
	quantities, Flow, Time, Frequency).	leterit killus of quantities to be maesured	(Liectical Quantities,	remperature, mechani	
	quantities, flow, fille, frequency).				
	They can describe important methods of chemical Analysis (Ga	s Sensors, Spectroscopy, Gas Chromatog	raphy)		
Skills	Students can select suitable measuring methods to given proble	ems and can use refering measurement de	evices in practice.		
	The students are able to orally explain issues in the subject area of measurement technology and solution approaches as well as place the issues in				
	the right context and application area.				
Personal Competence					
Social Competence	Students can arrive at work results in groups and document the	m in a common report.			
Autonomy	Students are able to familiarize themselves with new measuren	nent technologies.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70				
Credit points	6				
Examination	Written exam				
Examination duration and scale	105 minutes				
Assignment for the Following	General Engineering Science (German program): Specialisatio		Compulsory		
Curricula	General Engineering Science (German program): Specialisatio				
	General Engineering Science (German program): Specialisatio				
	General Engineering Science (German program): Specialisatio				
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): S				
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory				
	Energy and Environmental Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory General Engineering Science (English program): Specialisation Process Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): S				
	General Engineering Science (English program, 7 semester): S				
	Mechanical Engineering: Core qualification: Compulsory	pos.aoation i roocos Engineening. Comp	u,		
	Mechatronics: Core qualification: Compulsory				
	Process Engineering: Core qualification: Compulsory				



Тур	Laboratory Course
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Wolfgang Schröder
Language	DE
Cycle	WiSe/SoSe
Content	Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants
	automotive exhaust are used.
	Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigate
	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 Mich
	interferometer and optical fibers demonstrated.
	Experiment 4:Identification of the parameters of a control system and optimal control parameters
Literature	Versuch 1:
	Little We Dis Assistant des L. Grand Through and the control of the Alexandra and Advantage C. A. G. Williams
	 Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenscha
	 Verlagsgesellschaft, Stuttgart, 1974 Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, Mür
	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:
	Leaphard Fiaffihrung in die Degelungstrahnik Vieuse Verlag, Braunschweig Wieshaden
	 Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden Jan Lunze: Systemtheoretische Grundlagen, Analyse und Entwurf einschleifiger Regelungen
	• oan canze. Cystemuleorensone Grandiagen, Analyse and Entwart emstimentiger negetangen



Course L1116: Measurement Techn	ology for Mechanical and Process Engineers	
Тур	Lecture	
Hrs/wk	2	
CP Workload in Hours	3 Independent Study Time 62, Study Time in Lecture 28	
Lecturer	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	
	Oscilloscope	
	Analog-to-Digital Conversion	
	2.6 Data Transmission	
	3 Measurement of Nonelectric Quantities	
	3.1 Temperature	
	3.2 Length, Displacement, Angle	
	3.3 Strain, Force, Pressure	
	3.4 Flow	
	3.5 Time, Frequency	
	4 Chemical Analysis	
	4.1 Gas Sensors	
	4.2 Spectroscopy	
	4.3 Gas Chromatography	
	At the end of each lecture students present single measuring techniques and results orally in front of the class.	
Literature	Lerch, R.: "Elektrische Messtechnik; Analoge, digitale und computergestützte Verfahren", Springer, 2006, ISBN: 978-3-540-34055-3.	
	Profos, P. Pfeifer, T.: "Handbuch der industriellen Messtechnik", Oldenbourg, 2002, ISBN: 978-3486217940.	

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



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

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



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



Module M0610: Electrical M	lachines				
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	nding equations and o	haracteristic curves For	
	typically used drives they can explain the major parameters of the	·			
	typically used drives they can explain the major parameters of the	energy emolericy of the whole system i	Tom the power grid to the	e driveri erigirie.	
Skills	Students arw able to calculate two-dimensional electric and magn	etic fields in particular ferromagnetic c	ircuits with air gap. For	this they apply the usua	
	methods of the design auf electric machines.				
	They can calulate the operational performance of electric machine	e from their given characteristic data a	nd calacted auantities a	nd characteristic curves	
	They apply the usual equivalent circuits and graphical methods.	s nom their given characteristic data a	na serectea quantities a	na characteristic curves	
	They apply the usual equivalent circuits and graphical methods.				
B					
Personal Competence					
Social Competence					
Autonomy	Students are able independently to calculate electric and magn				
	performance of electric machines from the charactersitic data and t	heycan calculate thereof selected qua	ntities and characteristic	curves.	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70				
	6				
Credit points					
Examination	Written exam				
Examination duration and scale	120 Minuten				
Assignment for the Following	General Engineering Science (German program): Specialisation E				
Curricula	General Engineering Science (German program): Specialisation N		•		
	General Engineering Science (German program, 7 semester): Spe	**		/	
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering: E	lective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory	deen.			
	Energy and Environmental Engineering: Core qualification: Compr		Compulsor.		
	General Engineering Science (English program): Specialisation El	**			
	General Engineering Science (English program): Specialisation M General Engineering Science (English program, 7 semester): Specialisation M		•		
	General Engineering Science (English program, 7 semester): Spec		ecuve Compulsory		
	Computational Science and Engineering: Specialisation Engineer				
	Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory				
	Mechanical Engineering: Core qualification: Elective Compulsory				
	Mechatronics: Core qualification: Compulsory				



Course L0293: Electrical Machines	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	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	ecitation 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	oSe			
Content	xercises to the application of electric and magnetic fields.			
	Excercises to the operational performance of eletric machines.			
Literature	Hermann Linse, Roland Fischer: "Elektrotechnik für Maschinenbauer", Vieweg-Verlag; Signatur der Bibliothek der TUHH: ETB 313			
	Ralf Kories, Heinz Schmitt-Walter: "Taschenbuch der Elektrotechnik"; Verlag Harri Deutsch; Signatur der Bibliothek der TUHH: ETB 122			
	"Grundlagen der Elektrotechnik" - anderer Autoren			
	Fachbücher "Elektrische Maschinen"			



Module M0934: Advanced I	Mataviala			
Module M0934: Advanced I	wateriais			
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 fo	ollowing learning results		
Professional Competence				
Knowledge	The students will be able to explain the properties of ac	lvanced materials along with their applications	in technology, in par	ticular metallic, ceramic,
	polymeric, semiconductor, modern composite materials (b	iomaterials) and nanomaterials.		
Skilla	The students will be able to colect metarial configuration	as asserting to the technical peeds and if no	account to decign no	w motoriolo conciderina
Skills	The students will be able to select material configuration architectural principles from the micro- to the macroscale.		•	-
	select optimum materials combinations depending on the		dem materials science	e, which enables them to
	select optimitin materials combinations depending on 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. 			
	• define tasks independently.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Speciali	isation Mechanical Engineering: Elective Comp	ulsory	
Curricula	General Engineering Science (German program, 7 semes	ter): Specialisation Mechanical Engineering: Ele	ective Compulsory	
	General Engineering Science (English program): Specialis	sation Mechanical Engineering: Elective Compu	ilsory	
	General Engineering Science (English program, 7 semest	er): Specialisation Mechanical Engineering: Ele	ctive Compulsory	
	Mechanical Engineering: Core qualification: Elective Com	pulsory		
	*			

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	Porous Solids - Preparation, Characterization and Functionalities			
	Fluidics with nanoporous membranes			
	. X-ray diffraction for microstructure analysis			
	. Thermoplastic elastomers			
	. Optimization of polymer properties by nanoparticles			
	. 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	Typ Recitation Section (large)			
Hrs/wk	2			
СР	2			
Workload in Hours	pendent Study Time 32, Study Time in Lecture 28			
Lecturer	of. Bodo Fiedler, Prof. Stefan Müller, Prof. Patrick Huber, Prof. Gerold Schneider, Prof. Jörg Weißmüller			
Language	age DE/EN			
Cycle	Cycle SoSe			
Content	see interlocking course			
Literature	See interlocking course			



Focus Biomechanics

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

Module M0597: Advanced	Mechanical Engineering Design				
Courses					
Title		Тур	Hrs/wk	CP	
Advanced Mechanical Engineering Design		Lecture	2	2	
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1 2	
Advanced Mechanical Engineering Design Advanced Mechanical Engineering Design		Lecture Recitation Section (large)	2	1	
Module Responsible		reduction decision (large)			
Admission Requirements					
Recommended Previous					
Knowledge	 Fundamentals of Mechanical Engineering Design 				
Kilowicago	Mechanics				
	Fundamentals of Materials Science				
	Production Engineering				
Educational Objectives	After taking part successfully, students have reached the fol	lowing learning results			
Professional Competence					
Knowledge					
	3				
	explain complex working principles and functions of				
	explain requirements, selection criteria, application		achine elements,		
	indicate the background of dimensioning calculation	is.			
Skills	After passing the module, students are able to:				
	accomplish dimensioning calculations of covered m				
	transfer knowledge learned in the module to new reconstruction.				
	recognize the content of technical drawings and sch	ematic 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 according to the state of the				
	Students are able to acquire additional knowledge	e and to recapitulate poorly understood conte	ent e.g. by using the	e video recordings of the	
	lectures.				
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112				
Credit points	6				
Examination	Written exam				
Examination duration and scale	120				
Assignment for the Following	General Engineering Science (German program): Specialis	ation Mechanical Engineering, Focus Energy S	ystems: Compulsory		
Curricula	General Engineering Science (German program): Specialis	ation Mechanical Engineering, Focus Aircraft S	ystems Engineering:	Compulsory	
	General Engineering Science (German program): Specialis	ation Mechanical Engineering, Focus Materials	in Engineering Scie	nces: Compulsory	
	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory				
	General Engineering Science (German program): Specialis	ation Mechanical Engineering, Focus Product D	Development and Pro	oduction: Compulsory	
	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory				
	General Engineering Science (German program, 7 semeste	er): Specialisation Mechanical Engineering, Foc	us Aircraft Systems E	Engineering: Compulso	
	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 semes	ster): Specialisation Mechanical Engineering,	Focus Product Deve	elopment and Production	
	Compulsory				
	General Engineering Science (German program, 7 seme	ester): Specialisation Mechanical Engineering,	Focus Ineoretical	Mechanicai Engineerii	
	Compulsory	or): Charielization Machanical Engineering Foo	ua Biamashanias C	ampulaan.	
	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 Materials in Engineering Sciences. Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory				
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory				
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production. Computer General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Computer General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (English program): Specialisation Mechanica				
	General Engineering Science (English program, 7 semeste		-		
	General Engineering Science (English program, 7 seme				
	Compulsory				
	Compulsory General Engineering Science (English program, 7 semeste	r): Specialisation Mechanical Engineering, Focu	us Mechatronics: Co	mpulsory	
	General Engineering Science (English program, 7 semeste				

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



Compulsory

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

Course L0264: Advanced Mechanic	al Engineering Design II			
Тур				
Hrs/wk	2			
СР				
Workload in Hours	dependent 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			
	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			
	xercise			
	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)			
	Galculations of hydrostatic systems (induces)			
Literature				
	 Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. 			
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.			
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.			
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.			
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.			
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.			
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.			
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.			
	Sowie weitere Bücher zu speziellen Themen			

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



Course L0262: Advanced Mechanic	al Engineering Design I			
	Lecture			
Hrs/wk	2			
CP	2			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28			
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff			
	DE			
Language				
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			
	tercise			
	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			
	The state of the s			

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



Module M1277: MED I: Introd	luction to Anatomy				
Courses					
Title		Тур	Hrs/wk	CP	
Introduction to Anatomy (L0384)		Lecture	2	3	
	Prof. Udo Schumacher				
	None				
	None				
Knowledge					
-	After taking part successfully, students have reached the followi	ng learning results			
Professional Competence	, , , , , , , , , , , , , , , , , , ,				
Knowledge					
•	The students can describe				
ı	pasal structures and functions of internal organs and the muscu	loskeletal system			
	The students can describe the basic macroscopy and microscop	by of those systems.			
Skills	The students can recognize the relationship between given an	atomical facts and the development	of common diseases; they ca	n explain the relevance	
•	of structures and their functions in the context of widespread diseases.				
Personal Competence					
·	The students can participate in current discussions in biomedic	al research and medicine on a profes	ssional level		
	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				
1	relevant knowledge themselves.				
Workload in Hours	ndependent 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): Specialisatio	n Mechanical Engineering, Focus Bio	omechanics: Compulsory		
Curricula	General Engineering Science (German program): Specialisatio	n Biomedical Engineering: Compulso	ory		
	General Engineering Science (German program, 7 semester): S	Specialisation Biomedical Engineerin	ig: Compulsory		
,	General Engineering Science (German program, 7 semester): S	Specialisation Mechanical Engineering	ng, Focus Biomechanics: Con	npulsory	
1	Electrical Engineering: Specialisation Medical Technology: Elec	ctive Compulsory			
	General Engineering Science (English program): Specialisation	n Mechanical Engineering, Focus Bio	mechanics: Compulsory		
	General Engineering Science (English program): Specialisation	Biomedical Engineering: Compulso	ory		
	General Engineering Science (English program, 7 semester): S			pulsory	
	General Engineering Science (English program, 7 semester): S			•	
	Mechanical Engineering: Specialisation Biomechanics: Compu		· ·		
	Biomedical Engineering: Specialisation Medical Technology ar	•	ory		
	Biomedical Engineering: Specialisation Management and Busin				
	Biomedical Engineering: Specialisation Artificial Organs and Re	·	•		
	Biomedical Engineering: Specialisation Implants and Endopros	•	•		
	Fechnomathematics: Specialisation III. Engineering Science: El				



Course L0384: Introduction to Anato	omy
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Tobias Lange
Language	DE
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		<u> </u>		
itle		Тур	Hrs/wk	СР
gnals and Systems (L0432)		Lecture	3	4
gnals and Systems (L0433)		Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch			
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge	The modul is an introduction to the theory of signals and syste	ems. Good knowledge in maths as covere	ed by the moduls Mat	hematik 1-3 is exner
	Further experience with spectral transformations (Fourier series			
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and lines			
	to apply the fundamental transformations of continuous-time and			
	and systems mathematically in both time and image domain.		in time domain and i	mage domain which
	caused by the transition of a continuous-time signal to a discrete			
Skills	The students are able to describe and analyse deterministic signal analyse	•	-	
	can analyse and design basic systems regarding important pro		ponse, stability, linear	rity etc They can as
	the impact of LTI systems on the signal properties in time and fre	equency domain.		
Personal Competence				
Social Competence	The students can jointly solve specific problems.			
Autonomy	The students are able to acquire relevant information from app		rol their level of know	rledge during the lea
	period by solving tutorial problems, software tools, clicker system	n.		
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	n Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	Computer Science: Compulsory		
	General Engineering Science (German program): Specialisation	n Process Engineering: Compulsory		
	General Engineering Science (German program): Specialisation	n Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation	n Civil- and Enviromental Engeneering: Co	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): S			
	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): S			
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	g, Focus Materials ir	Engineering Scien
	Compulsory			
	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester	: Specialisation Mechanical Engineering	, Focus Theoretical I	Mechanical Enginee
	Compulsory			
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specialisation	Civil- and Environmental Engagements	mouleon	
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation		привогу	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): S		ulsory	
	General Engineering Science (English program, 7 semester): S	pecialisation Computer Science: Compulso	ory	
	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S	pecialisation Mechanical Engineering, Foc	us Biomechanics: Co	mpulsory
	General Engineering Science (English program, 7 semester): S	pecialisation Mechanical Engineering, Foc	us Energy Systems: C	ompulsory
	General Engineering Science (English program, 7 semester): S	pecialisation Mechanical Engineering, Foc	us Aircraft Systems Er	ngineering: Compuls
	General Engineering Science (English program, 7 semester			
	Compulsory			-
	General Engineering Science (English program, 7 semester): S	pecialisation Mechanical Engineering, Foc	us Mechatronics: Con	npulsory
	General Engineering Science (English program, 7 semester)	: Specialisation Mechanical Engineering	Focus Theoretical M	Mechanical Enginee
	Compulsory			
	Computational Science and Engineering: Core qualification: Co	mpulsory		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

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



Module M1278: MED I: Intro	oduction to Radiology and Radiation Therapy
Courses	
ïtle	Typ Hrs/wk CP
ntroduction to Radiology and Radiation The Module Responsible	herapy (L0363) Lecture 2 3 Prof. Ulrich Carl
Admission Requirements	None
Recommended Previous	None
Knowledge	After the live and a second fill, who death have a solved the fall assistance and the
Educational Objectives Professional Competence	After taking part successfully, students have reached the following learning results
Knowledge	
	Therapy
	The students can distinguish different types of currently used equipment with respect to its use in radiation therapy.
	The students can explain complex treatment plans used in radiation therapy in interdisciplinary contexts (e.g. surgery, internal medicine).
	The students can describe the patients' passage from their initial admittance through to follow-up care.
	Diagnostics
	The students can illustrate the technical base concepts of projection radiography, including angiography and mammography, as well as section
	imaging techniques (CT, MRT, US).
	The students can explain the diagnostic as well as therapeutic use of imaging techniques, as well as the technical basis for those techniques.
	The students can choose the right treatment method depending on the patient's clinical history and needs.
	The student can explain the influence of technical errors on the imaging techniques.
	The student can draw the right conclusions based on the images' diagnostic findings or the error protocol.
Skills	
	Therapy
	The students can distinguish curative and palliative situations and motivate why they came to that conclusion.
	The students can develop adequate therapy concepts and relate it to the radiation biological aspects.
	The students can use the therapeutic principle (effects vs adverse effects)
	The students can distinguish different kinds of radiation, can choose the best one depending on the situation (location of the tumor) and choose t energy needed in that situation (irradiation planning).
	The student can assess what an individual psychosocial service should look like (e.g. follow-up treatment, sports, social help groups, self-help groups social services, psycho-oncology).
	Diagnostics
	The students can suggest solutions for repairs of imaging instrumentation after having done error analyses.
	The students can classify results of imaging techniques according to different groups of diseases based on their knowledge of anatomy, pathology a pathophysiology.
Personal Competence	
Social Competence	
	The students can assess the special social situation of tumor patients and interact with them in a professional way.
	The students are aware of the special, often fear-dominated behavior of sick people caused by diagnostic and therapeutic measures and can meet the
	appropriately.
Autonomy	The students can apply their pay knowledge and skills to a congrete they are
	The students can apply their new knowledge and skills to a concrete therapy case. The students can introduce a support students to the eligible delity routine.
	The students can introduce younger students to the clinical daily routine.
	The students are able to access anatomical knowledge by themselves, can participate competently in conversations on the topic and acquire t relevant knowledge themselves.
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Credit points	
Examination Examination duration and scale	Written exam 90 minutes
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Curricula	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory Electrical Engineering: Specialisation Medical Technology: Elective Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (Enginer program, 7 Semester). Specialisation biomedical Engineering: Compulsory



Mechanical Engineering: Specialisation Biomechanics: Compulsory

Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory

Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory

Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory

Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0383: Introduction to Radio	ology and Radiation Therapy
Тур	Lecture
Hrs/wk	2
CP Waster die Hause	3
Workload in Hours Lecturer	Independent Study Time 62, Study Time in Lecture 28
Language	Prof. Ulrich Carl, Prof. Thomas Vestring DE
Cycle	SoSe
Content	The students will be given an understanding of the technological possibilities in the field of medical imaging, interventional radiology and radiation therapy/radiation oncology. It is assumed, that students in the beginning of the course have heard the word "X-ray" at best. It will be distinguished between the two arms of diagnostic (Prof. Dr. med. Thomas Vestring) and therapeutic (Prof. Dr. med. Ulrich Carl) use of X-rays. Both arms depend on special big units, which determine a predefined sequence in their respective departments
Literature	"Technik der medizinischen Radiologie" von T. + J. Laubenberg –
	7. Auflage – Deutscher Ärzteverlag – erschienen 1999
	"Klinische Strahlenbiologie" von Th. Herrmann, M. Baumann und W. Dörr –
	4. Auflage - Verlag Urban & Fischer – erschienen 02.03.2006
	ISBN: 978-3-437-23960-1
	"Strahlentherapie und Onkologie für MTA-R" von R. Sauer –
	5. Auflage 2003 - Verlag Urban & Schwarzenberg – erschienen 08.12.2009
	ISBN: 978-3-437-47501-6
	"Taschenatlas der Physiologie" von S. Silbernagel und A. Despopoulus
	8. Auflage – Georg Thieme Verlag - erschienen 19.09.2012
	ISBN: 978-3-13-567708-8
	"Der Körper des Menschen " von A. Faller u. M. Schünke -
	16. Auflage 2004 – Georg Thieme Verlag – erschienen 18.07.2012
	ISBN: 978-3-13-329716-5
	"Praxismanual Strahlentherapie" von Stöver / Feyer –
	Auflage - Springer-Verlag GmbH – erschienen 02.06.2000



nts and Testing 1977) Prof. Michael Morlock	Typ Lecture	Hrs/wk	
	Lecture	Hrs/wk	
	Lecture	Hrs/wk	
			CP
Prof Michael Morlock		2	3
Prof Michael Morlock	Lecture	2	3
T TO IT MILOTICO I MIOTICO II			
None			
It is recommended to participate in "Implantate und Fraktu	urheilung" before attending "Experimentelle Me	ethoden".	
After taking part successfully, students have reached the	following learning results		
The students can describe the different ways how bones	heal, and the requirements for their existence.		
The students can name different treatments for the spine	and hollow bones under given fracture morph	ologies.	
The students can describe different measurement technic	ques for forces and movements, and choose th	e adequate technique for	a given task.
The students can determine the forces acting within the h	uman body under quasi-static situations unde	r specific assumptions.	
The students can describe the basic handling of several	experimental techniques used in biomechanic	s.	
The students can, in groups, solve basic experimental tas	sks.		
The students can, in groups, solve basic experimental tas	sks.		
Independent Study Time 124, Study Time in Lecture 56			
6			
Written exam			
90 minutes, many questions			
General Engineering Science (German program): Specia	lisation Mechanical Engineering, Focus Biome	echanics: Compulsory	
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		Focus Biomechanics: Cor	mpulsory
General Engineering Science (German program, 7 seme	ster): Specialisation Biomedical Engineering:	Compulsory	
General Engineering Science (English program): Special	lisation Biomedical Engineering: Compulsory		
		echanics: Compulsory	
General Engineering Science (English program, 7 semes	ster): Specialisation Mechanical Engineering, I	Focus Biomechanics: Con	npulsory
General Engineering Science (English program, 7 semes	ster): Specialisation Biomedical Engineering: 0	Compulsory	
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	After taking part successfully, students have reached the The students can describe the different ways how bones The students can name different treatments for the spine The students can describe different measurement technic The students can determine the forces acting within the h The students can describe the basic handling of several of The students can, in groups, solve basic experimental tas The students can, in groups, solve basic experimental tas The students can, in groups, solve basic experimental tas Independent Study Time 124, Study Time in Lecture 56 Written exam multiply The students can, in groups, solve basic experimental tas Independent Study Time 124, Study Time in Lecture 56 General Engineering Science (German program): Special General Engineering Science (German program, 7 seme General Engineering Science (German program, 7 seme General Engineering Science (English program, 7 semes Mechanical Engineering: Specialisation Biomechanics: C Biomedical Engineering: Specialisation Implants and English Biomedical Engineering: Specialisation Medical Technol Biomedical Engineering: Specialisation Management and	After taking part successfully, students have reached the following learning results The students can describe the different ways how bones heal, and the requirements for their existence. The students can name different treatments for the spine and hollow bones under given fracture morph. The students can describe different measurement techniques for forces and movements, and choose the students can describe the forces acting within the human body under quasi-static situations under the students can describe the basic handling of several experimental techniques used in biomechanic the students can, in groups, solve basic experimental tasks. The students can, in groups, solve basic experimental tasks. The students can, in groups, solve basic experimental tasks. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, many questions General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomedical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering; Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering; General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering; General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering; General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering; Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory	The students can describe the different ways how bones heal, and the requirements for their existence. The students can name different treatments for the spine and hollow bones under given fracture morphologies. The students can describe different measurement techniques for forces and movements, and choose the adequate technique for the students can describe different measurement techniques for forces and movements, and choose the adequate technique for the students can determine the forces acting within the human body under quasi-static situations under specific assumptions. The students can describe the basic handling of several experimental techniques used in biomechanics. The students can, in groups, solve basic experimental tasks. The students can, in groups, solve basic experimental tasks. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, many questions General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering; Compulsory General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering; Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Congeneral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Congeneral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering; Focus Biomechanics: Congeneral Engineering; Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory

Course L0377: Experimental Method	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



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



Courses				
Γitle		Тур	Hrs/wk	CP
Computer Engineering (L0321) Computer Engineering (L0324)		Lecture Recitation Section (small)	3 1	4
Module Responsible	Prof. Heiko Falk	rectitation occition (small)	•	L
Admission Requirements	None			
Recommended Previous	Basic knowledge in electrical engineering			
Knowledge				
	The successful completion of the labs will be honored or	uring the evaluation of the module's examination ac	cording to the following	ng rules:
	Upon a passed module examination, the studexamination's marks are lifted by 0,3 or 0,4, resp. The improvement of the grade 5,0 up to 4,3 and	ectively, up to the next-better grade.	ks due to the succes	ssful labs, such that t
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence Knowledge	This module deals with the foundations of the function gates. The module includes the following topics: • Introduction	ality of computing systems. It covers the layers fro	om the assembly-leve	el programming down
	Combinational logic: Gates, Boolean algebra, B Sequential logic: Flip-flops, automata, systemati Technological foundations Computer arithmetic: Integer addition, subtractic Basics of computer architecture: Programming n Memories: Memory hierarchies, SRAM, DRAM,	n, multiplication and division lodels, MIPS single-cycle architecture, pipelining		
Skills	The students perceive computer systems from the a computer systems. The students can analyze, how h components. They are able to distinguish between and up to complete processors.	ghly specific and individual computers can be bu	ilt based on a colle	ction of few and simp
Payagnal Competence	After successful completion of the module, the students executed on it. In particular, they shall understand the the assembly language down to gates. This way, they we performance and to propose feasible options.	consequences that the execution of software has or	the hardware-centri	c abstraction layers fro
Personal Competence Social Competence	Studente ere able to colve similar problems along or in	a group and to propert the regults accordingly		
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 spec	fic literature and to associate this knowledge with of	her classes.	
Workload in House	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Crean points	Written exam			
Examination				
Examination Examination duration and scale	90 minutes, contents of course and labs			
Examination Examination duration and scale Assignment for the Following	90 minutes, contents of course and labs General Engineering Science (German program): Core	' '	-	
Examination Examination duration and scale	90 minutes, contents of course and labs General Engineering Science (German program): Core General Engineering Science (German program, 7 sem	ester): Specialisation Computer Science: Compulso	-	
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Technomathematics: Specialisation II. Informatics: Elective Compulsory



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

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

Тур	Recitation Section (small)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Heiko Falk	
Language	DE	
Cycle		
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 shifte
- 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
- 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 M1279: MED II: Intra	oduction to Biochemistry and Molecul	ar Riology		
Wodule W1279: WED II: IN(r)	duction to blochemistry and wolecus	ar blology		
Courses				
Title		Тур	Hrs/wk	CP
Introduction to Biochemistry and Molecula	Biology (L0386)	Lecture	2	3
Module Responsible	Prof. Hans-Jürgen Kreienkamp			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge				
	The students can			
	 describe basic biomolecules; 			
	explain how genetic information is coded in t	he DNA;		
	explain the connection between DNA and pr			
Skills				
	The students can			
	recognize the importance of molecular paran	neters for the course of a disease;		
	describe different molecular-diagnostic treatr	ments;		
	describe the importance of those treatments for som	a diagona.		
	describe the importance of those treatments for some	e diseases,		
Personal Competence				
Social Competence				
	The students can conduct discussions in research a	nd medicine on a technical level.		
Autonomy	The students can develop understanding of topics fr	om the course, using technical literature, by thems	elves	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 2	28		
Credit points	3			
Examination	Written exam			
Examination duration and scale	60 minutes			
Assignment for the Following	General Engineering Science (German program): S			
Curricula	General Engineering Science (German program): S			
	General Engineering Science (German program, 7 s			
	General Engineering Science (German program, 7 s		, Focus Biomechanics: Com	pulsory
	Electrical Engineering: Specialisation Medical Technology		anhanian Camaulan	
	General Engineering Science (English program): Sp General Engineering Science (English program): Sp			
	General Engineering Science (English program, 7 s			nulsorv
	General Engineering Science (English program, 7 s			pa.co/ y
	Mechanical Engineering: Specialisation Biomechan	, ,	[
	Biomedical Engineering: Specialisation Management		ory	
	Biomedical Engineering: Specialisation Artificial Org			
	Biomedical Engineering: Specialisation Medical Tec	,	•	
	Biomedical Engineering: Specialisation Implants an	d Endoprostheses: Elective Compulsory		
	Technomathematics: Core qualification: Elective Co	mpulsory		
	$\label{thm:condition} \textbf{Technomathematics: Specialisation III. Engineering}$	Science: Elective Compulsory		

Course L0386: Introduction to Bioch	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 M0662: Numerical I	Mathematics I			
Courses				
Title		Тур	Hrs/wk	СР
lumerical Mathematics I (L0417)		Lecture	2	3
lumerical Mathematics I (L0418)		Recitation Section (small)	2	3
Module Responsible	Prof. Sabine Le Borne			
Admission Requirements	None			
Recommended Previous	Madharas Ch. L. II for Freign and a Charles to Assessment	and the board of the second of		
Knowledge	 Mathematik I + II for Engineering Students (german of basic MATLAB knowledge) 	r english) or Analysis & Linear Algebra i + ii ii	or recnnomainemalicia	ns
Educational Objectives	After taking part successfully, students have reached the foll	owing learning results		
Professional Competence				
Knowledge	Students are able to			
	name numerical methods for interpolation, integration	on loast squares problems, eigenvalue pro	blome poplinger root f	inding problems and
	 name numerical methods for interpolation, integrati explain their core ideas, 	on, least squares problems, eigenvalue pro	iblems, nominear root i	inding problems am
	 repeat convergence statements for the numerical me 	thods		
	explain aspects for the practical execution of numeric		d storage complexitx.	
Skills	Students are able to			
	implement, apply and compare numerical methods u	•		
	justify the convergence behaviour of numerical meth colors and execute a quitable colution approach for a		algorithm,	
	 select and execute a suitable solution approach for a 	given problem.		
Personal Competence				
Social Competence	Students are able to			
	 work together in heterogeneously composed teams 	(i.e. teams from different study programs a	nd background knowled	dae) evalain theore
	foundations and support each other with practical as			ige), explain theore
	loundations and support outri other with practical ac	people regarding the implementation of algorit	iiiio.	
Autonomy	Students are capable			
	 to assess whether the supporting theoretical and pra 	ctical excercises are better solved individually	v or in a team.	
	 to assess their individual progess and, if necessary, 		y 0 a toa,	
		<u> </u>		
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): Specialisa			
Curricula	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program): Specialisa	• •	Is in Engineering Scien	ces: Compulsory
	General Engineering Science (German program): Specialisa	* *	007/	
	General Engineering Science (German program, 7 semeste General Engineering Science (German program, 7 seme		•	Engineering Science
	Compulsory	ster). Specialisation Mechanical Engineerii	ig, rocus ivialenais in	Lingineering Scient
	General Engineering Science (German program, 7 semeste	r): Specialisation Biomedical Engineering: Co	omnulsorv	
	General Engineering Science (German program, 7 semeste			mpulsorv
	Bioprocess Engineering: Specialisation A - General Bioproc	, ,		.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	Computer Science: Specialisation Computational Mathemat			
	Electrical Engineering: Core qualification: Elective Compuls	ory		
	General Engineering Science (English program): Specialisa	tion Computer Science: Compulsory		
	General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisa	tion Mechanical Engineering, Focus Biomech	nanics: Compulsory	
	General Engineering Science (English program): Specialisa	tion Mechanical Engineering, Focus Material	s in Engineering Scienc	es: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compuls	sory	
	General Engineering Science (English program, 7 seme	ster): Specialisation Mechanical Engineering	ng, Focus Materials in	Engineering Science
	Compulsory			
	General Engineering Science (English program, 7 semester			
	General Engineering Science (English program, 7 semester		cus Biomechanics: Con	npulsory
	Computational Science and Engineering: Core qualification	• •		
	Process Engineering: Specialisation Process Engineering: F	- Jective Compulsory		

 ${\bf Process\ Engineering: Specialisation\ Process\ Engineering: Elective\ Compulsory}$



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		
Language	DE		
Cycle	WiSe		
Content	 Error analysis: Number representation, error types, conditioning and stability Interpolation: polynomial and spline interpolation Numerical integration and differentiation: order, Newton-Cotes formula, error estimates, Gaussian quadrature, adaptive quadrature, difference formulas Linear systems: LU and Cholesky factorization, matrix norms, conditioning Linear least squares problems: normal equations, Gram.Schmidt and Householder orthogonalization, singular value decomposition, regularization Eigenvalue problems: power iteration, inverse iteration, QR algorithm Nonlinear systems of equations: Fixed point iteration, root-finding algorithms for real-valued functions, Newton and Quasi-Newton methods for systems 		
Literature	Stoer/Bulirsch: Numerische Mathematik 1, Springer Dahmen, Reusken: Numerik für Ingenieure und Naturwissenschaftler, Springer		

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



Courses	
Title	Typ Hrs/wk CP
ntroduction to Control Systems (L0654)	Lecture 2 4 Recitation Section (small) 2 2
ntroduction to Control Systems (L0655)	
Module Responsible	
Admission Requirements	
Recommended Previous	Representation of signals and systems in time and frequency domain, Laplace transform
Knowledge	
Educational Objectives	
Professional Competence	
Knowledge	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second or
	systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.
	They can explain the role of the phase margin in analysis and synthesis of control loops
	They can explain the way a PID controller affects a control loop in terms of its frequency response
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally
01.11	
Skills	Students can transform models of linear dynamic systems from time to frequency domain and vice versa
	They can simulate and assess the behavior of systems and control loops
	They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules
	They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks
Davis and Commistance	
Personal Competence	
Social Competence	
Autonomy	
	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	i ·
Examination duration and scale	Written exam
	Written exam 120 min
Examination duration and scale	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science Compulsory
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering 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
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Ener
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energ
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focu
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Derman program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerin
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Scienc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Scienc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Michatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Demylsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus En
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Dioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory General Engineering: Core
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Bioprocess
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alicraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Alicraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Bioprocess Engineering Science (Engilish program, 7 semester): Specialisation Compuls
Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engin
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General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

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



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



Module M1280: MED II: Intro	oduction to Physiology
Courses	
	To United OB
Title	Typ Hrs/wk CP Lecture 2 3
Introduction to Physiology (L0385)	
Module Responsible	Dr. Roger Zimmermann
Admission Requirements	None
Recommended Previous	None
Knowledge	Affair to the same of the state of the same and the following leave in secular
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The students can
	The students can
	describe the basics of the energy metabolism;
	 describe physiological connections in select fields of muscle, heart/circulation, neuro- and sensory physiology.
Skills	
	The students can
	describe the effects of basic bodily functions (sensory, transmission and processing of information, development of forces and vital functions) are
	relate them to similar technical systems.
Personal Competence	
Social Competence	
	The students can conduct discussions in research and medicine on a technical level.
	The students can find solutions to problems in the field of physiology, both analytical and metrological
Autonomy	The students can develop understanding of topics from the course, using technical literature, by themselves
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Credit points	3
Examination	Written exam
Examination duration and scale	60 minutes
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Curricula	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	Electrical Engineering: Specialisation Medical Technology: Elective Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	Mechanical Engineering: Specialisation Biomechanics: Compulsory Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory
	Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory
	Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory
	Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory
	Technomathematics: Core qualification: Elective Compulsory
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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



Courses	
Title	Typ Hrs/wk CP
Introduction to Management (L0880)	Lecture 3 3
Project Entrepreneurship (L0882)	Problem-based Learning 2 3
Module Responsible	
Admission Requirements	
Recommended Previous Knowledge	
Educational Objectives	
Professional Competence	
Knowledge	
Skills	 explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions from field of Management explain the most important aspects of and goals in Management and name the most important aspects of entreprneurial projects describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and hun ressource management, information management, innovation management and marketing explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives and uncertainty, and expl some basic methods from mathematical Finance state basics from accounting and costing and selected controlling methods. Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry out Entrepreneurship project in a team. In particular, they are able to analyse Management goals and structure them appropriately analyse organisational and staff structures of companies apply methods for decision making under multiple objectives, under uncertainty and under risk analyse production and procurement systems and Business information systems analyse and apply basic methods from mathematical finance to predefined problems apply basic methods from accounting, costing and controlling to predefined problems
Personal Competence Social Competence	
Autonomy	Students are able to work in a team and to organize the team themselves to write a report on their project.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Examination	Written exam
Examination duration and scale	90 Minuten
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 Bioprocess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Energy and Environmental Engineering: Compulsory
	General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineeri



Compulsory

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

ompulsory

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

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

Energy and Environmental Engineering: Core qualification: Compulsory

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

 $\label{thm:condition} \textbf{General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory and the second seco$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

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

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

Technomathematics: Core qualification: Compulsory



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

Course L0882: Project 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
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 Energy Systems

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

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

	Engineering		
Courses			
Title	Тур	Hrs/wk	CP
Computer Engineering (L0321)	Lecture	3	4
Computer Engineering (L0324)	Recitation Section (small)	1	2
Module Responsible			
Admission Requirements	None		
Recommended Previous			
Knowledge	The successful completion of the labs will be honored during the evaluation of the module's examina	tion according to the following	rules:
		o o	
	Upon a passed module examination, the student is granted a bonus on the examination	n's marks due to the successf	ful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	This module deals with the foundations of the functionality of computing systems. It covers the lay	yers from the assembly-level	programming dowr
	gates. The module includes the following topics:		
	to be a district		
	Introduction Combinational logic Cotes Papelson plants: Deplace functions the discount for the papelson functions.		
	 Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combin Sequential logic: Flip-flops, automata, systematic hardware design 	national networks	
	Technological foundations		
	Computer arithmetic: Integer addition, subtraction, multiplication and division		
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelin	nina	
	Memories: Memory hierarchies, SRAM, DRAM, caches	mig	
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point core.	nnections, busses	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the	internal structure and the ph	nysical composition
	computer systems. The students can analyze, how highly specific and individual computers can		
	components. They are able to distinguish between and to explain the different abstraction layers of	today's computing systems - f	from gates and circ
	up to complete processors.		
	After successful completion of the module, the students are able to judge the interdependencies be	tween a physical computer sy	stem and the softw
	executed on it. In particular, they shall understand the consequences that the execution of software	has on the hardware-centric a	abstraction layers fr
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels leading to the control of the c		e 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	у.	
Autonomy	Students are able to acquire new knowledge from specific literature and to associate this knowledge	with other classes.	
	Indopondont Study Time 124 Study Time in Lecture 56		
Washing die Hause	Independent Study Time 124, Study Time in Lecture 56		
Workload in Hours			
Credit points			
Credit points Examination	Written exam		
Credit points Examination Examination duration and scale	Written exam 90 minutes, contents of course and labs		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	maidage	
Credit points Examination Examination duration and scale	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Core		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Col General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineerin	g: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineerin General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cor	g: Compulsory mpulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Coi General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineerin General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Coi General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com	g: Compulsory mpulsory npulsory	
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Cot General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineerin General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Cot General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineerin General Engineering Science (German program, 7 semester): Specialisation Energy and Environmen General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerin General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerin General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerin General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerin General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerin General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerin General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerin General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerin	g: Compulsory inpulsory compulsory g: Compulsory g: Compulsory tal Engineering: Compulsory compulsory ig, Focus Mechatronics: Comp ig, Focus Biomechanics: Comp ig, Focus Aircraft Systems Eng ineering, Focus Materials in E	oulsory ineering: Compulso Engineering Scienc chanical Engineeri



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

Computer Science: Core qualification: Compulsory

Electrical Engineering: Core qualification: Compulsory

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation II. Informatics: Elective Compulsory

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

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



ourses				
le		Tun	Hrs/wk	CP
		Typ Lecture	Hrs/wk 3	4 4
nals and Systems (L0432) nals and Systems (L0433)		Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch		·	
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge	Waterinates 1 0			
	The modul is an introduction to the theory of signals and systems. Grunther experience with spectral transformations (Fourier series, Fourier series)	•	•	ematik 1-3 is expe
Educational Objectives	After taking part successfully, students have reached the following lear	rning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and linear time	-invariant (LTI) systems using metho	ods of signal and syste	m theory. They are
	to apply the fundamental transformations of continuous-time and discr	ete-time signals and systems. They	can describe and analy	yse deterministic sig
	and systems mathematically in both time and image domain. In par	ticular, they understand the effects	in time domain and in	nage 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 a	and linear time-invariant systems us	ing methods of signal a	and system theory.
	can analyse and design basic systems regarding important properties	s such as magnitude and phase res	ponse, stability, lineari	ty etc They can as
	the impact of LTI systems on the signal properties in time and frequence	cy domain.		
Personal Competence				
Social Competence	The students can jointly solve specific problems.			
Autonomy	The students are able to acquire relevant information from appropria	te literature sources. They can con-	trol their level of know	ledge during the le
	period by solving tutorial problems, software tools, clicker system.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
	6	-	-	
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Elect	trical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Com			
Curricula	General Engineering Science (German program): Specialisation Proceedings of the Communication			
	General Engineering Science (German program): Specialisation Froction			
	General Engineering Science (German program): Specialisation Civil-		ampuleon/	
	General Engineering Science (German program): Specialisation Mech		піршзоту	
	General Engineering Science (German program): Specialisation Biom			
	General Engineering Science (German program, 7 semester): Special		oulsory	
	General Engineering Science (German program, 7 semester): Special			
	General Engineering Science (German program, 7 semester): Special			
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	General Engineering Science (German program, 7 semester): Special		• • •	
	General Engineering Science (German program, 7 semester): Special			
	Compulsory	ciansation Mechanical Engineering	g, rocus Materiais III	Lingineering Scie
		ication Machanical Engineering Eq	ous Moshatronies: Con	anulcon.
	General Engineering Science (German program, 7 semester): Special			
	General Engineering Science (German program, 7 semester): Spe-	Jansanon wechanical Engineering	, rocus ineoretical M	iechanicai Enginee
	Computer Science: Core qualification: Computer v			
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specialisation Civil-	and Environmental Engangering: O-	mpuleory	
	General Engineering Science (English program): Specialisation Civil- General Engineering Science (English program): Specialisation Biopr		привоту	
	General Engineering Science (English program): Specialisation Biopri General Engineering Science (English program): Specialisation Electronic			
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	General Engineering Science (English program): Specialisation Procedure (English program): Specialisation			
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	General Engineering Science (English program, 7 semester): Spe	ciansation wechanical Engineering	g, rocus materiais in	Engineering Scie
	Compulsory General Engineering Science (English program, 7 semester): Specialis	sation Machanical Engineering For	oue Machatranias C	nulson;
	General Engineering Science (English program, 7 semester): Speciali			
	General Engineering Science (English program, 7 semester): Spec	Jansanon wechanical Engineering	, rocus ineoretical M	echanical Engine
	Compulsory			
	Compulsory Computational Science and Engineering: Core qualification: Compuls			



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	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.

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



Module M0684: Heat Transf	fer			
Courses				
Title		Tun	Hrs/wk	CP
		Typ Lecture	3	5
Heat Transfer (L0458) Heat Transfer (L0459)		Recitation Section (large)	2	1
Module Responsible	Dr. Andreas Moschallski	ricolitation occiton (large)	2	
Admission Requirements	none			
Recommended Previous	Technical Thermodynamics I, II and Fluid Dynamics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	earning results		
Professional Competence				
Knowledge	The students are able to			
	- describe the different physical mechanism of Heat Transfer,			
	- explain the technical terms,			
	- to analyse comlex heat transfer processes in a critical way.			
Skills	The students are able to			
	- understand the physics of Heat Transfer,			
	- calculate and evaluate complex Heat Transfer processes,			
	- solve excersises self-consistent and in small groups.			
Personal Competence				
Social Competence	The students are able to discuss in small groups and develop an a	oproach.		
Autonomy	The students are able to develop a complex problem self-consiste	nt and analyse the results in a critical wa	y. A qualified exchan	ge with other students is
•	given.	,	,	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation M	echanical Engineering, Focus Biomecha	anics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation M		ystems: Compulsory	
	General Engineering Science (German program): Specialisation B			
	General Engineering Science (German program): Specialisation M			
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): S	specialisation Mechanical Engineering,	Focus Theoretical N	lechanical Engineering:
	Compulsory			
	General Engineering Science (German program, 7 semester): Spe		pulsory	
	General Engineering Science (English program): Specialisation Bi			
	General Engineering Science (English program): Specialisation Me			
	General Engineering Science (English program): Specialisation Me			
	General Engineering Science (English program): Specialisation Me			
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): S Compulsory	pecialisation Mechanical Engineering,	rocus Ineoretical N	ecnanical Engineering:
	General Engineering Science (English program, 7 semester): Spec	ialisation Biomedical Engineering: Com	pulsory	
	Mechanical Engineering: Specialisation Energy Systems: Compuls			
	Mechanical Engineering: Specialisation Theoretical Mechanical En	ngineering: Compulsory		

Course L0458: Heat Transfer	
Тур	Lecture
Hrs/wk	3
CP	5
Workload in Hours	Independent Study Time 108, 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	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Dr. Andreas Moschallski	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Courses	
Title	Typ Hrs/wk CP
Introduction to Control Systems (L0654) Introduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2
Module Responsible Admission Requirements	
Recommended Previous	
Knowledge	representation of signals and systems in time and nequency domain, Laplace transform
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	
	 Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second or
	systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus They can explain the Mynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus. They can explain the Mynamics 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 sale of the above growing is explained and expl
	 They can explain the role of the phase margin in analysis and synthesis of control loops They can explain the way a PID controller affects a control loop in terms of its frequency response
	They can explain the way a Fib controller allects a control loop in terms of its frequency response They can explain issues arising when controllers designed in continuous time domain are implemented digitally
	They can explain locate alienty when controlled designed in containable time definant are importanted 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
Personal Competence	
Social Competence	Students can work in small groups to jointly solve technical problems, and experimentally validate their controller designs
Autonomy	
	problems.
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.
Workload in Hours	
Credit points	6
Credit points Examination	6 Written exam
Credit points Examination Examination duration and scale	6 Written exam 120 min
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Credit points Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science (Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanicalis in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and 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): Specialisat
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 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 Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Co
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Devoress Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 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 Memochanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Memochanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Com
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Displace (Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Enginee



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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

e L0654: Introduction to Contr	ol Systems
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems
	Linear systems, differential equations and transfer functions
	First and second order systems, poles and zeros, impulse and step response
	Stability
	Feedback systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Root locus techniques
	Root locus plots
	Root locus design of PID controllers
	Frequency response techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation
	Frequency response interpretation of PID control
	Time delay systems
	Post logge and fraguency response of time delay systems.
	Root locus and frequency response of time delay systems Smith predictor
	Digital control
	Sampled-data systems, difference equations
	Tustin approximation, digital implementation of PID controllers
	Software tools
	Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010



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



	Mechanical Engineering Design			
Courses				
itle		Тур	Hrs/wk	CP
dvanced Mechanical Engineering Design	ı II (L0264)	Lecture	2	2
dvanced Mechanical Engineering Design		Recitation Section (large)	2	1
dvanced Mechanical Engineering Design	ı I (L0262)	Lecture	2	2
dvanced Mechanical Engineering Design	I (L0263)	Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	Fundamentals of Mechanical Engineering Des	ign		
Knowledge	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
Educational Objectives	After taking part successfully etudents have reached t	no following loarning recults		
Educational Objectives	After taking part successfully, students have reached the	le lollowing learning results		
Professional Competence Knowledge	After passing the module, students are able to:			
Knowledge	Alter passing the module, students are able to.			
	 explain complex working principles and function 	ons of machine elements and of basic elements of flui	idics,	
	explain requirements, selection criteria, application	ation scenarios and practical examples of complex ma	achine elements,	
	 indicate the background of dimensioning calculates 	lations.		
Skills	After passing the module, students are able to:			
SAMO				
	accomplish dimensioning calculations of cover			
	-	ew requirements and tasks (problem solving skills),		
	recognize the content of technical drawings an	d schematic sketches,		
	evaluate complex designs, technically.			
Personal Competence				
Social Competence				
	 Students are able to discuss technical informat 	ion in the lecture supported by activating methods.		
Autonomy				
	Students are able to independently deepen the			
	'	rledge and 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 11.	2		
Credit points	6			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Spe	cialisation Mechanical Engineering, Focus Energy S	ystems: Compulsory	
Curricula	General Engineering Science (German program): Spe			Compulsory
	General Engineering Science (German program): Spe	cialisation Mechanical Engineering, Focus Materials	in Engineering Scien	nces: Compulsory
	General Engineering Science (German program): Spe	cialisation Mechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (German program): Spe	cialisation Mechanical Engineering, Focus Product C	Development and Pro	duction: Compulsory
	General Engineering Science (German program): Spe	cialisation Mechanical Engineering, Focus Theoretic	al Mechanical Engin	eering: Compulsory
	General Engineering Science (German program, 7 ser			
	General Engineering Science (German program, 7	semester): Specialisation Mechanical Engineering	g, Focus Materials in	n Engineering Science
	Compulsory	and a contract to the contract of		
	General Engineering Science (German program, 7 ser	nester): Specialisation Mechanical Engineering, Foci	us Mechatronics: Co	
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	General Engineering Science (German program, 7 s	semester): Specialisation Mechanical Engineering, i	Focus Product Deve	
	Compulsory			lopment and Production
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	Compulsory General Engineering Science (German program, 7 Compulsory	semester): Specialisation Mechanical Engineering,	Focus Theoretical I	lopment and Production
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Course L0264: Advanced Mechanic	al Engineering Design II	
Тур	Lecture	
Hrs/wk		
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	
	a. Fundamentals 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)	
Literature	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.	
	 Dubber, Taschenbuch für den Maschinenbau; Grote, NH., Peldnüsen, 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. 	
	 Maschinen- und Konstruktionseiernenie; Steinnliper, W., Hoper, H., Springer Verlag, aktuelle Auliage. Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. 	
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. Macchingagiomenta 1.2: Schlacht B. Pagger Verlag, aktuelle Auflage.	
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. Maschinenelemente Costelling Paracharus Asuna duran Unbarbarus II. Badasatsia F. Carinasa Vadas altitulla Auflaga.	
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Pol. (Antal Machine et australia Ministration of the Control of the C	
	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	



Course L0262: Advanced Mechanic	al Engineering Design I
	Lecture
Hrs/wk	2
CP	2
	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
	Advanced Mechanical Engineering Design I & II
Content	Advanced mechanical Engineering Design 1 d 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 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.
	Coulo unitara Diinhaana anniallan Tharran
	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 M0655: Computation	onal Fluid Dynamics I			
0				
Courses		T	Hrs/wk	CP
Computational Fluid Dynamics I (L0235)		Typ Lecture	Hrs/wk	3
Computational Fluid Dynamics I (L0419)		Recitation Section (large)	2	3
Module Responsible	Prof. Thomas Rung	, ,		
Admission Requirements	None			
Recommended Previous				
Knowledge	Mathematical Methods for Engineers			
	 Fundamentals of Differential/integral calculus and series exp 	ansions		
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence				
Knowledge	The students are able to list the basic numerics of partial differential	equations.		
Skills	The students are able develop appropriate numerical integration	in space and time for the governing	partial differential ed	quations. They can code
	computational algorithms in a structured way.			
Personal Competence				
Social Competence	The students can arrive at work results in groups and document ther	n		
Codial Competence	The stateme can arrive at work results in groups and document ther			
Autonomy	The students can independently analyse approaches to solving spec	cific problems.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	2h			
Assignment for the Following	General Engineering Science (German program): Specialisation Me		Systems: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Na	• •	on	
	General Engineering Science (German program, 7 semester): Speci General Engineering Science (German program, 7 semester): Speci			Elective Compulsory
	General Engineering Science (Gennari program): Specialisation Nav		ous Energy Systems. I	_ioonva Oompulaory
	General Engineering Science (English program): Specialisation Med		ystems: Compulsorv	
	General Engineering Science (English program, 7 semester): Specia			
	General Engineering Science (English program, 7 semester): Specia	·	-	lective Compulsory
	Naval Architecture: Core qualification: Compulsory	- 0,	·	
	Technomathematics: Specialisation III. Engineering Science: Electiv	e Compulsory		
	Technomathematics: Specialisation III. Engineering Science: Electiv	e Compulsory		

Course L0235: Computational Fluid Dynamics I		
Тур	ecture	
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	
	6. Formulation of boundary conditions and initial conditions 7. Assembly and solution of algebraic equation systems 8. Facets of weighted -residual approaches 9. Finite volume methods 10. Basics of grid generation	
Literature	Ferziger and Peric: Computational Methods for Fluid Dynamics, Springer	



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



Module M0639: Gas and Ste	eam Power Plants			
Courses				
Title Gas and Steam Power Plants (L0206)		Typ Lecture	Hrs/wk	CP 4
Gas and Steam Power Plants (L0210)		Recitation Section (large)	2	2
Module Responsible	Prof. Alfons Kather			
Admission Requirements	None			
Recommended Previous	"Technical Thermodynamics I and II"			
Knowledge	"Heat Transfer"			
	"Fluid Mechanics"			
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence	The laking part successionly, stadents have reached	The following realiting results		
Knowledge	types of power plant and the layout of the steam ge describe the exhaust gas cleaning apparatus and of	lectricity demand and the energy conversion routes is enerator block and determine the operation characte other environmental protection measures, along with wind) power plants or plants equipped with Carbon C.	ristics of the power plant the combination pos	ant. Additionally they ca
	acidification, fine particulate or CO ₂ emissions and	s, operation and design of turbomachinery. They are the resulting climatic effects. They are able to name	and discuss the chal	lenges in plant operatio
	supply and network stability, also with economics con	d renewable energy sources and can name the opt nsidered.	ımai technicai options	for providing security (
The students are able, using theories and methods of the energy technology from fossil fuels and based on deep knowledge on construction of gas and steam power plants, to identify basic associations in the production of heat and electricity, so as to deversion solutions. Through analysis of the problem and exposure to the inherent interconnections between heat and power generation, the endowed with the capability and methodology to develop realistic optimal concepts for the environmentally benign generation of production of heat. From the technical basics the students become the ability to follow better the deliberations on the electricity mix of the energy-political triangle (economy, secure supply and environmental protection).		to develop conceptionation, the students will be		
	The students are able to highlight aspects of the Professional TM and to independently program simpli	e design and development of power plant cycles ified power plant process simulations.	with the specialised	software suite EBSILO
	The students are able to do simplified calculations of	f turbo machinery as either an overall plant or as indiv	vidual stages.	
Personal Competence				
Social Competence	The students are able to solve subject-specific exerc	ises in smalls groups and can present their common	results orally.	
	The students are able to analyze suitable technical support the energy revolution effectively.	alternatives to reduce the environmental and social	ll footprint of their eng	ineering activities and t
Autonomy	The students assisted by the tutors will be able to o	·		•
	theoretical and practical knowledge from the lecture is consolidated and the potential effects from different process combinations and boundary conditions highlighted. The students are able to analyse independently the operational performance of steam power plants and calculate selected			
	quantities and characteristic curves.	nalyse independently the operational performance	of steam power plant	s and calculate selecte
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): Sp	pecialisation Energy and Enviromental Engineering: 0	Compulsory	
Curricula		pecialisation Mechanical Engineering, Focus Energy		
		emester): Specialisation Energy and Environmental En		
		emester): Specialisation Mechanical Engineering, Fo	cus Energy Systems:	=lective Compulsory
		cation: Compulsory		
	Energy and Environmental Engineering: Core qualifi	solution Energy and Engineers and Engineers	`ampulaanı	
	General Engineering Science (English program): Sp	ecialisation Energy and Environmental Engineering: C		
	General Engineering Science (English program): Sp General Engineering Science (English program): Sp	ecialisation Mechanical Engineering, Focus Energy S	Systems: Compulsory	v
	General Engineering Science (English program): Sp General Engineering Science (English program): Sp General Engineering Science (English program, 7 se		Systems: Compulsory gineering: Compulsor	



urse 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 shermal 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 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
	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 the 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.
	A multi-day excursion within the framework of the lecture is planned for those students that are interested. The students thus get direct contact with the whole subject field of gas and steam power plants. Through discussions with plant personnel the students are able to obtain an overview on dai operation problems and their solution approach.
	This activity hinges, however, upon the availability of support financing and as such it cannot always be guaranteed.
Literature	Kalide: Kraft- und Arbeitsmaschinen
	Thomas, H.J.: Thermische Kraftanlagen. Springer-Verlag, 1985
	Strauß, K.: Kraftwerkstechnik. Springer-Verlag, 2006
	Straub, K.: Krailwerkslechnik. Springer-Verlag, 2006 Kugeler und Phlippen: Energietechnik. Springer-Verlag, 1990
	 T. Bohn (Hrsg.): Handbuchreihe Energie, Band 7: Gasturbinenkraftwerke, Kombikraftwerke, Heizkraftwerke und Industriekraftwerke, Technisch
	Verlag Resch / Verlag TÜV Rheinland
	Vollag 100017 Vellag 10 V Fillelinanu



Hrs/wk	Recitation Section (large)
	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Alfons Kather
Language	DE
	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
	<u> </u>
	The environmental impact of acidification, fine particulate or CO ₂ emissions and the resulting climatic effects are a special focus of the lecture and
	lecture hall exercise. The challenges in plant operation from interconnecting conventional power plants and renewable energy sources are discussional power plants.
	and the technical options for providing security of supply and network stability are presented, also under consideration of cost effectiveness. In
	critical review, focus is especially placed on the compatibility of the different solutions with the environment and climate. With this, the awareness for
	responsibility of an engineer's own actions are emphasized and the potential extent of the different solutions presented clearly.
	Within the framework of the exercise the students learn the use of the specialised software suite EBSILON Professional TM. With this tool small tasks
	solved on the PC, to highlight aspects of the design and development of power plant cycles. The students present their results orally and can afterward
	ask questions and get feedback. The course work has a positive effect on the students final grade.
	and questions and get recubation. The course work has a positive energy of the calculation must grade.
Literature	9.00
	Kelida Kraft und Arbeitsmagebingen
	Kalide: Kraft- und Arbeitsmaschinen Thomas H. I.: Thormische Kraftenlagen, Springer Verlag, 1995.
	Thomas, H.J.: Thermische Kraftanlagen. Springer-Verlag, 1985 Strauß, K.: Kraftwarksteehalk, Springer-Verlag, 2006
	Strauß, K.: Kraftwerkstechnik. Springer-Verlag, 2006 Kvanlauurd Philipper, Francischabeils, Springer-Verlag, 1000
	 Kugeler und Phlippen: Energietechnik. Springer-Verlag, 1990 T. Bohn (Hrsg.): Handbuchreihe Energie, Band 7: Gasturbinenkraftwerke, Kombikraftwerke, Heizkraftwerke und Industriekraftwerke, Technis



Module M1022: Reciprocating Machinery				
Courses				
Title		Тур	Hrs/wk	СР
Fundamentals of Reciprocating Engines a	nd Turbomachinery - Part Reciprocating Engines (L0633)	Lecture	1	1
Fundamentals of Reciprocating Engines and Turbomachinery - Part Reciprocating Engines (L0634)		Recitation Section (large)	1	1
Internal Combustion Engines I (L0059)		Lecture	2	2
Internal Combustion Engines I (L0639)		Recitation Section (large)	1	2
Module Responsible	Prof. Christopher Friedrich Wirz			
Admission Requirements	None			
Recommended Previous	Thermodynamics, Mechanics, Machine Elements			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge Skills	machinery and describe the qualitative and quantitative correlations of operating methods and efficiencies of multiple types of engines, compressors and pumps. They are able to utilize technical terms and parameters as well as aspects regarding the development of power density and efficiency, furthermore to give an overview of charging systems, fuels and emissions. The students are able to select specific types of machinery and assess design related and operational problems. As a result of the part module "Internal Combustion Engines I", the students are able reflect and utilize the state-of-the-art regarding efficiency limits. In addition, they are able to utilize their knowledge of design, mechanical and thermodynamic characteristics and the approach of similarity. They are able to explain, assess and develop engines as well as charging systems. Detailed knowledge is present regarding computer-aided process design.			
Personal Competence				
Social Competence	The students are able to communicate and cooperate in a professional environment in the field of machinery design and application.			
Autonomy	The widespread scope of gained knowledge enables the students to handle situations in their future profession independently and confidently.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Energy	Systems: Compulsory	
Curricula				
	General Engineering Science (English program): Specialisation I	Mechanical Engineering, Focus Energy S	Systems: Compulsory	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Mechanical Engineering, Foo	cus Energy Systems: 0	Compulsory
	Mechanical Engineering: Specialisation Energy Systems: Compu	Isory		



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

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

Course L0059: Internal Combustion 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	Calculation of tasks to:	
	 Design of of motors Real process calculation Charging methods Kinematics of the crank mechanism Forces in the engine 	
Literature	Vorlesungsskript	



odule M0829: Foundation	ns of Management			
ourses				
tle	Ту	p	Hrs/wk	СР
roduction to Management (L0880)		cture	3	3
oject Entrepreneurship (L0882)	Pro	oblem-based Learning	2	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning resu	ults		
Professional Competence				
Knowledge	After taking this module, students know the important basics of many different Marketing and Innovation, and also to Investment and Controlling. In particular		anagement, from Plani	ning and Organisation
	explain the differences between Economics and Management and the s field of Management	sub-disciplines in Manager	nent and to name impo	ortant definitions from
	field of Management	me the most important sen	acts of antroproducial	araiaata
	 explain the most important aspects of and goals in Management and na describe and explain basic business functions as production, procure 			
	ressource management, information management, innovation management		onam management,	organization and nan
	explain the relevance of planning and decision making in Business, each of the second se	-	ultiple objectives and	uncertainty, and expl
	some basic methods from mathematical Finance	yop oldadollo allaoi	anapio objectivos ana	arroomarriy, arra oxp
	state basics from accounting and costing and selected controlling metho	ods.		
Skills	Students are able to analyse business units with respect to different co	riteria (organization, obje	ctives, strategies etc	.) and to carry out
	Entrepreneurship project in a team. In particular, they are able to			
	analyse Management goals and structure them appropriately			
	analyse organisational and staff structures of companies			
	apply methods for decision making under multiple objectives, under under under multiple objectives.	ertainty and under risk		
	analyse production and procurement systems and Business information	systems		
	analyse and apply basic methods of marketing			
	select and apply basic methods from mathematical finance to predefine	d problems		
	apply basic methods from accounting, costing and controlling to predefin	ned problems		
Personal Competence				
Social Competence				
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepreneurship project	and write a coherent repor	rt on the project	
	to communicate appropriately and			
	to cooperate respectfully with their fellow students.			
Autonomy	Students are able to			
	work in a team and to organize the team themselves			
	to write a report on their project.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points				
Examination				
Examination duration and scale				
Assignment for the Following		ineering: Compulsory		
Curricula				
Odificula	General Engineering Science (German program): Specialisation Process Engin	' '		
	General Engineering Science (German program): Specialisation Bioprocess Engineering Science (German Program): Specialisation B			
	General Engineering Science (German program): Specialisation Energy and En		Compulsory	
	General Engineering Science (German program): Specialisation Civil- and Env			
	General Engineering Science (German program): Specialisation Mechanical En		, inputed y	
	General Engineering Science (German program): Specialisation Biomedical Er			
	General Engineering Science (German program): Specialisation Naval Architec			
	General Engineering Science (German program, 7 semester): Specialisation El		oulsorv	
	General Engineering Science (German program, 7 semester): Specialisation Pr			
	General Engineering Science (German program, 7 semester): Specialisation Bi			
	General Engineering Science (German program, 7 semester): Specialisation No			
	General Engineering Science (German program, 7 semester): Specialisation Co	•	•	
	General Engineering Science (German program, 7 semester): Specialisation Bi		-	
	General Engineering Science (German program, 7 semester): Specialisation Ci			
	General Engineering Science (German program, 7 semester): Specialisation En			у
	General Engineering Science (German program, 7 semester): Specialisation M			
	General Engineering Science (German program, 7 semester): Specialisation M			
	General Engineering Science (German program, 7 semester): Specialisation M	-		
	General Engineering Science (German program, 7 semester). Specialisation will General Engineering Science (German program, 7 semester): Specialisation will be seen that the seminary of the s	-	•	
	Compulsory	weenanca Engineenn	y, i ocus iviateriais If	. Engineering ocient
		n Machanical Engineering	Foolie Theoretical	Achanical Essins
	General Engineering Science (German program, 7 semester): Specialisation	i wechanical Engineering	, rocus ineoretical l	viecnanicai Engineeri



Compulsory

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

inipulsory

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

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

Energy and Environmental Engineering: Core qualification: Compulsory

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

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

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

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

 $\label{thm:computer:compulsor} General\ Engineering\ Science\ (English\ program)\ :\ Specialisation\ Computer\ Science\ :\ Compulsory\ (Computer\ Science\ Compulsory\ Computer\ Science\ Compulsory\ (Computer\ Science\ Compulsory\ Computer\ Science\ Compulsory\ (Computer\ Science\ Compulsory\ Computer\ Science\ Computer\ Science\ Computer\ Science\ Computer\ Science\ (Computer\ Science\ Computer\ Science\ Co$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

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

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

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

Technomathematics: Core qualification: Compulsory



ourse L0880: Introduction to Manag	gement
Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgan
	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 Managemer 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	Important aspects of Entrepreneurship projects Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.
	Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Course L0882: Project 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	
Language	DE	
Cycle	WiSe/SoSe	
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,	
	using their knowledge from the corresponding lecture.	
	Project work is carried out in teams with the support of a mentor.	
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.	



Module M0618: Renewable	s and Energy Systems			
Courses				
Title		Тур	Hrs/wk	CP
Power Industry (L0316)		Lecture	1	1
Energy Systems and Energy Industry (L03	315)	Lecture	2	2
Renewable Energy (L0313)		Lecture	2	2
Renewable Energy (L1434)		Recitation Section (small)	1	1
Module Responsible	Prof. Martin Kaltschmitt			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	With completion of this module, the students can provide a	n overview of characteristics of energy sys	tems and their econd	mic efficiency. They can
	explain the issues occurring in this context. Furthermore, they	can explain details of power generation, po	ower distribution and	power trading wih regard
	to subject-related contexts. The students can explain these a	spects, which are applicable to many energ	y systems in general,	especially for renewable
	energy systems and critical discuss them. Furthermore, the stu	idents can explain the environmental benefi	ts from the use of such	systems.
Skills	Students are able to apply methodologies for detailed dete	rmination of energy demand or energy pro-	oduction for various t	vpes of energy systems.
	Furthermore, they can evaluate energy systems technically	***		
	Therefore, they can choose the necessary subject-specific cal	•	-	sortam given conditions.
	Therefore, they can choose the necessary subject-specific car	culation rules, also for not standardized sold	tions of a problem.	
	The students are able to explain questions and possible app	roaches to its processing from the field of re	enewable energies ora	ally and to put them them
	into the right context.			
Personal Competence				
Social Competence	The students are able to analyze suitable technical alter	natives and to assess them with technic	al, economical and	ecological criteria under
	sustainability aspects. This allows them to make an effective of	ontribuition to a more sustainable power sup	oply.	
Autonomy	Students can independently exploit sources, acquire the part	oular knowledge about the subject area and	transform it to now a	loctions
Autonomy	Students can independently exploit sources , acquire the part	cular knowledge about the subject area and	transionii it to new qu	iestions.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	3 hours written exam			
Assignment for the Following	General Engineering Science (German program): Specialisati	on Energy and Enviromental Engineering: C	Compulsory	
Curricula	General Engineering Science (German program, 7 semester)			rv
Junious	General Engineering Science (German program, 7 semester)			•
	Energy and Environmental Engineering: Core qualification: C			
	General Engineering Science (English program): Specialisation		omnulsory	
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester):	opedialisation wechanical Engineering, Foo	us Energy Systems: E	lective Compulsory

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



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

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

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



Focus Aircraft Systems Engineering

The area of specialization "Aircraft System Engineering" prepares participating students for diverse kind of professions in the field of aviation and related industries. Students learn how to use typical methods of systems engineering as well as the application of modern, computer-based techniques for system design, analysis and evaluation. Furthermore required knowledge from different fields of aviation including aircraft systems and air transportation system is discussed.

Additionally students get insight into current research activities, e.g. in the area of fuel cells and electrical energy supply, actuators, avionics systems and software or hydraulic energy supply.

спетду зарргу.				
Module M0597: Advanced	Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	СР
Advanced Mechanical Engineering Design	n II (I 0264)	Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Module Responsible		· · · · · · · · · · · · · · · · · · ·		
Admission Requirements				
Recommended Previous				
Knowledge	Fundamentals of Mechanical Engineering Design			
Knowledge	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the followin	g learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	explain complex working principles and functions of mach	nine elements and of hasic elements of fluir	dics	
	explain complex working principles and tallottels of mach explain requirements, selection criteria, application scena			
	indicate the background of dimensioning calculations.	and practical examples of complex me	torinic cicinents,	
	indicate the background of differentiationing calculations.			
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of covered machin			
	transfer knowledge learned in the module to new requirer			
	recognize the content of technical drawings and schemat	ic sketches,		
	evaluate complex designs, technically.			
Personal Competence				
Social Competence				
occiai competence	Students are able to discuss technical information in the I	ecture supported by activating methods.		
A. 4				
Autonomy	Students are able to independently deepen their acquired	d knowledge in exercises.		
	Students are able to acquire additional knowledge and	d to recapitulate poorly understood conte	nt e.g. by using the	video recordings of the
	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	Mechanical Engineering, Focus Energy Sy	stems: Compulsory	
Curricula	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Aircraft Sy	stems Engineering:	Compulsory
	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Materials	in Engineering Scier	nces: Compulsory
	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Mechatron	nics: Compulsory	
	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Product D	evelopment and Pro	duction: Compulsory
	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Theoretica	al Mechanical Engin	eering: Compulsory
	General Engineering Science (German program, 7 semester): Sp	pecialisation Mechanical Engineering, Focu	us Aircraft Systems E	ingineering: Compulsory
	General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering	, Focus Materials in	Engineering Sciences
	Compulsory			
	General Engineering Science (German program, 7 semester): Sp	pecialisation Mechanical Engineering, Focu	us Mechatronics: Co	mpulsory
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, F	ocus Product Deve	lopment 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): Sp	pecialisation Mechanical Engineering, Focu	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Sp	pecialisation Mechanical Engineering, Focu	us Energy Systems:	Compulsory
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Energy Sy	stems: Compulsory	
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Aircraft Sy	stems Engineering:	Compulsory
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Materials i	n Engineering Scien	ices: Compulsory
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Mechatron	ics: Compulsory	
I	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Product De	evelopment and Pro-	duction: Compulsory
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Theoretica	l Mechanical Engine	eering: Compulsory
	General Engineering Science (English program, 7 semester): Sp		-	
	General Engineering Science (English program, 7 semester)			
	Compulsory			
	•			



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

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

Compulsory

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

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
Content	Advanced meditation Engineering Design 1 & 1
	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. Auflage
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Tieführung in die DIN Negronal/Leie M. Tauhan Welen.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. Vonstruktionslahen Dehl C. Beite W. Springer Verlag althoute Auflage
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. Maching a garagete 1.0: Splingth B. Pagang Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. Maschinenelemente - Cashkura - Parachura - Anguardura - University - Parachura - Cashkura - Parachura - Anguardura - University - Parachura - Cashkura - Parachura - Anguardura - University - Parachura - Cashkura - Parachura - Anguardura - University - Parachura
	 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.
	- Note: Made Made Materials (Thirties, Thirties, Thirties, D.) Summaden, D., Folker, e., Opininger Herroy, anadenic Adhlage.
	Sowie weitere Bücher zu speziellen Themen

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



Course L0262: Advanced Mechanic	al Engineering Design I	
	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	WiSe	
Content	Advanced Mechanical Engineering Design I & II	
	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 hydrotetic systems (fluidics)	
	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	
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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				
ïtle		Тур	Hrs/wk	CP
ignals and Systems (L0432)		Lecture	3	4
ignals and Systems (L0433)	Draf Carbard Rough	Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch None			
Admission Requirements Recommended Previous	Mathematics 1-3			
Knowledge	Mathematics 1-3			
,	The modul is an introduction to the theory of signals and system Further experience with spectral transformations (Fourier series, Fourier series).	•	•	nematik 1-3 is exped
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	ime-invariant (LTI) systems using metho	ds of signal and syste	em theory. They are
	to apply the fundamental transformations of continuous-time and $\ensuremath{\text{d}}$	screte-time signals and systems. They o	an describe and anal	yse deterministic sig
	and systems mathematically in both time and image domain. In		in time domain and in	mage domain which
	caused by the transition of a continuous-time signal to a discrete-ti	ne signal.		
Skills	The students are able to describe and analyse deterministic signal			
	can analyse and design basic systems regarding important prope		oonse, stability, linear	ity etc They can as
	the impact of LTI systems on the signal properties in time and frequency	ency domain.		
Personal Competence	The students are fairly to the			
Social Competence	The students can jointly solve specific problems.		and the state of the state	todos a de la composición
Autonomy	The students are able to acquire relevant information from appro	priate literature sources. They can cont	ror their level of know	reage during the lea
Madde - 45-11-	period by solving tutorial problems, software tools, clicker system. Independent Study Time 124, Study Time in Lecture 56			
Workload in Hours				
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation E			
Curricula	General Engineering Science (German program): Specialisation C			
	General Engineering Science (German program): Specialisation F General Engineering Science (German program): Specialisation B			
	General Engineering Science (German program): Specialisation C		mnulsory	
	General Engineering Science (German program): Specialisation M			
	General Engineering Science (German program): Specialisation B			
	General Engineering Science (German program, 7 semester): Spe		ulsory	
	General Engineering Science (German program, 7 semester): Spe	cialisation Computer Science: Compuls	ory	
	General Engineering Science (German program, 7 semester): Spe	cialisation Process Engineering: Compu	ılsory	
	General Engineering Science (German program, 7 semester): Spe	cialisation Bioprocess Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester): Spe	cialisation Biomedical Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering, Foo	cus Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): Compulsory	Specialisation Mechanical Engineering	g, Focus Materials in	Engineering Scien
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering, Foo	us Mechatronics: Cor	npulsorv
	General Engineering Science (German program, 7 semester): \$			
	Compulsory	J - J		Q 11
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation C		mpulsory	
	General Engineering Science (English program): Specialisation B			
	General Engineering Science (English program): Specialisation E			
	General Engineering Science (English program): Specialisation C			
	General Engineering Science (English program): Specialisation M			
	General Engineering Science (English program): Specialisation B			
	General Engineering Science (English program): Specialisation Pogeneral Engineering Science (English program, 7 semester): Specialisation Pogeneral Engineering Science (English program, 7 semester): Specialisation Pogeneral Engineering Science (English program): Specialisation Engineering Science (English program):		uleon	
	General Engineering Science (English program, 7 semester): Sper			
	General Engineering Science (English program, 7 semester): Spe-			
	General Engineering Science (English program, 7 semester): Spec		•	
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): Spec			npulsory
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester):			
	Compulsory			
	General Engineering Science (English program, 7 semester): Spec	cialisation Mechanical Engineering, Foc	us Mechatronics: Con	pulsory
	General Engineering Science (English program, 7 semester): 9	specialisation Mechanical Engineering,	Focus Theoretical M	Mechanical Enginee
	Compulsory			
	Computational Science and Engineering: Core qualification: Comp Mechatronics: Core qualification: Compulsory	pulsory		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

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



Module M0596: Advanced	Mechanical Design Project		
Courses			
Title	Тур	Hrs/wk	СР
Advanced Mechanical Design Project (L0)	1266) Practical Course	4	6
Module Responsible	Prof. Dieter Krause		
Admission Requirements	None		
Recommended Previous			
Knowledge	Mechanical Engineering: Design		
	Advanced Mechanical Engineering Design		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	After passing the module, students are able to:		
	oversee the precedure for eveteratically handling of		
	 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.		
	The second secon		
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-o 	riented,	
	create a technical documentation including all necessary technical drawings to understar		
	document calculations of selected machine elements clearly and in detail.	•	
Personal Competence			
Social Competence	After passing the module, students are able to:		
	 present and discuss solutions and technical drawings within groups, 		
	reflect the own results in the work groups of the course		
Autonomy	After passing the module students are able to		
Autonomy	After passing the module, students are able to:		
	independently solve complex design projects, while motivating themselves, acquiring near	cessary knowledge and selectin	g appropriate methods
	to independently solve problems.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points			
Examination			
Examination duration and scale	180		
Assignment for the Following		s Aircraft Systems Engineering:	Compulsory
Curricula			
	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engine		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Eng	gineering, Focus Product Devel	opment and Production
	Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical En	ngineering, Focus Theoretical M	Mechanical Engineeri
	Compulsory		
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus	Aircraft Systems Engineering: C	Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus	Product Development and Prod	duction: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus	Theoretical Mechanical Engine	ering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engine	ering, Focus Aircraft Systems Er	ngineering: Compulso
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Eng	ineering, Focus Product Devel	opment and Production
	Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical En	gineering, Focus Theoretical M	Mechanical Engineeri
	Compulsory		
	Mechanical Engineering: Core qualification: Compulsory		



Course L0266: Advanced Mechanical Design Project				
Тур	Practical Course			
Hrs/wk	4			
CP	6			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff, Dr. Jens Schmidt, Dr. Volkert Wollesen			
Language	DE			
Cycle	WiSe			
Content	Das Konstruktionsprojekt gliedert sich in den Entwurf eines Getriebes sowie die Lösungsfindung.			
	Getriebekonstruktion in Einzelarbeit			
	Erarbeitung von Lösungsprinzipien			
	Berechnung von Maschinenelementen			
	Entwurf eines Getriebes im Hauptschnitt plus allen Außenansichten			
	 Erstellung einer ausführlichen Dokumentation 			
	Lösungsfindung			
	 Methodische Erarbeitung von prinzipiellen Lösungskonzepten 			
	Erstellen einer Dokumentation			
Literature	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.			
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.			
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.			
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.			
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.			
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.			
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.			
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.			
	Sowie weitere Bücher zu speziellen Themen			



Module M1320: Simulation	and Design of Mechatronic Systems			
Courses				
Title		Тур	Hrs/wk	CP
· · · · · · · · · · · · · · · · · · ·	ation and Design of Mechatronic Systems (L1822) Lecture 2 2			
Simulation and Design of Mechatronic Sys				
Simulation and Design of Mechatronic Sys		Recitation Section (large)	1	2
Module Responsible				
Admission Requirements	None			
Recommended Previous	Fundatmentals of mechanics, control theory and electrical engineering	g		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following lea	arning results		
Professional Competence				
Knowledge	Students are able to describe methods and calculations for design, m	odeling, simulation and optimization	of mechatronic systen	ns.
21.11				
Skills	Students are able to apply modern algorithms for modeling of model	echatronic systems. They can identi	ty, simulate and des	ign simple systems and
	implement those in laboratory conditions.			
Personal Competence				
Social Competence	Students are able to work goal-oriented in small mixed groups and pr	esent results to target groups.		
Autonomy	Students are able to recognize and improve knowledge deficits indep	pendently.		
	With instructor assistance, students are able to evaluate their own known	owledge level and define a further cou	urse of study.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Med	hanical Engineering, Focus Mechatro	nics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Med	hanical Engineering, Focus Aircraft S	ystems Engineering:	Compulsory
	General Engineering Science (German program): Specialisation Med	hanical Engineering, Focus Theoretic	cal Mechanical Engine	eering: Compulsory
	General Engineering Science (German program, 7 semester): Specia	ulisation Mechanical Engineering, Foo	cus Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semester): Specia	llisation Mechanical Engineering, Foo	cus Aircraft Systems E	ngineering: Compulsory
	General Engineering Science (German program, 7 semester): Spe	ecialisation Mechanical Engineering	Focus Theoretical N	Mechanical Engineering:
	Elective Compulsory			
	General Engineering Science (English program): Specialisation Med	nanical Engineering, Focus Aircraft Sy	ystems Engineering: 0	Compulsory
	General Engineering Science (English program): Specialisation Med			, ,
	General Engineering Science (English program): Specialisation Med			ering: Compulsory
	General Engineering Science (English program, 7 semester): Specia		-	
	General Engineering Science (English program, 7 semester): Specia			
	General Engineering Science (English program, 7 semester): Spe		•	
	Elective Compulsory			
	Mechanical Engineering: Specialisation Aircraft Systems Engineering	g: Compulsory		
	Mechanical Engineering: Specialisation Mechatronics: Compulsory	,		
	Mechanical Engineering: Specialisation Theoretical Mechanical Engi	neering: Compulsory		
	Mechatronics: Core qualification: Compulsory	A 6		

Course L1822: Simulation and Design of Mechatronic Systems		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	Mechatronic Design	
	Modeling	
	Model Identifikation	
	Numerical Methods in simulation	
	Applications and examples in Matlab [®] and Simulink [®]	
Literature	Skript zur Veranstaltung	
	Weitere Literatur in der Veranstaltung	



Course L1824: Simulation and Design of Mechatronic Systems		
Тур	Laboratory	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1823: Simulation and Design of Mechatronic Systems		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Courses		
ïtle	Typ Hrs/wk CP	
ntroduction to Control Systems (L0654) ntroduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2	
Module Responsible	Prof. Herbert Werner	
Admission Requirements	none	
Recommended Previous	Representation of signals and systems in time and frequency domain, Laplace transform	
Knowledge		
Educational Objectives	Attacks in a contract of the standards become a should the fall action to a south	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence Knowledge		
Milowieuge	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and sec	ond ord
	systems	
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus	
	They can explain the Nyquist stability criterion and the stability margins derived from it.	
	They can explain the role of the phase margin in analysis and synthesis of control loops	
	They can explain the way a PID controller affects a control loop in terms of its frequency response The control is the way at 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 costs leave with the help of they signify (7 relea Nichele) trains miles.	
	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 analyze and synthesize simple control loops with the help of root locus and frequency response techniques They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation 	
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks	
	- They can use standard software tools (matter context, climating) of earlying out these tasks	
Personal Competence		
Social Competence	Students can work in small groups to jointly solve technical problems, and experimentally validate their controller designs	
Autonomy	Students can obtain information from provided sources (lecture notes, software documentation, experiment guides) and use it when solven	ing giv
	problems.	
	I hey can assess their knowledge in weekly on-line tests and thereby control their learning progress	
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Workload in Hours	Iney can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56	
Workload in Hours Credit points	Independent Study Time 124, Study Time in Lecture 56	
	Independent Study Time 124, Study Time in Lecture 56	
Credit points	Independent Study Time 124, Study Time in Lecture 56 6 Written exam	
Credit points Examination	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min	
Credit points Examination Examination duration and scale	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering. Focus Mechatronics: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
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Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Cogeneral Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Compulsory	Science
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Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus 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 Materials in Engineering Compulsory	Science Science
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Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus 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 Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and P Compulsory	Science
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering 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 Engenerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and P	Science
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Siver Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Cogeneral 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 P Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory	Science
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Forey and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems 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 Meterials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engeneral Engineering Science (German program, 7 semester): Specialisation Mechan	Science Science
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Syst	Science Science
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus 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 Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and P Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Gener	Science Science
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 Divil 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 Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mec	Scienc
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Dividi Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory 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: Cogeneral 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 Product Development and P Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and P Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	Scienc
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and P Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Comp	Scienc
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Science (German program, 7 semester): Specialisation Science (German program, 7 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 Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micrati Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and P Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and P Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Eng	Scienc
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Supprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus 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 Product Development and P Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and P Compulsory General Engineering Science (Engilish program, 7 semester): Specialisation Mech	Science Science
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Sioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: 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 P Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanica	Science



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

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

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

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

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

Compulsory

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

Compulsory

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

Process Engineering: Core qualification: Compulsory

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



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



Courses		
Title Computer Engineering (L0321)	Typ Hrs/wk CP Lecture 3 4	
Computer Engineering (L0321)	Lecture 3 4 Recitation Section (small) 1 2	
Module Responsible	Prof. Heiko Falk	
Admission Requirements		
Recommended Previous		
Knowledge		
	The successful completion of the labs will be honored during the evaluation of the module's examination according to the following rules:	
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the successful labs, so	uch that t
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.	
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge		ing down
· ·	gates. The module includes the following topics:	
	• Introduction	
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks Seguential logic: Flip-flops, automata, systematic hardware design	
	 Sequential logic: Flip-flops, automata, systematic hardware design Technological foundations 	
	Computer arithmetic: Integer addition, subtraction, multiplication and division	
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining	
	Memories: Memory hierarchies, SRAM, DRAM, caches	
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses	
· · · ·		
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the physical cor	
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a collection of few	
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing systems - from gates up to complete processors.	and circi
	up to complete processors.	
	After successful completion of the module, the students are able to judge the interdependencies between a physical computer system and	the softwa
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-centric abstraction	layers fr
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels have on an en	tire syste
	performance and to propose feasible options.	
Personal Competence		
Social Competence		
,		
Autonomy	/ Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Workload in Hours Credit points		
Credit points	6	
Credit points Examination	6 Written exam	
Credit points Examination Examination duration and scale	Written exam 90 minutes, contents of course and labs	
Credit points Examination	6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: 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 Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Compulsory	g Science
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (Germ	g Scienc
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Technomathematics: Specialisation II. Informatics: Elective Compulsory



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

Course L0321: Computer Engineering	ng	
Тур	octure	
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. 	

Тур	Recitation Section (small)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Heiko Falk	
Language	DE	
Cycle		
	1. Introduction	
	Principles of digital design	
	Analog versus Digital	
	Gates and flip-flops	
	Aspects of digital design	
	Integrated cicuits	
	Digital devices	
	Time-to-market	
	10 New to 20 stores and 20 stores	
	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	
	Logis signals and gates	
	Logic signals and gates Logic formilian	
	Logic families	
	CMOS logic	
	CMOS circuits: electrical behavior	



- 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 shifte
- 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
- 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 M0599: Integrated I	Product Development and Lightweight Design	1		
Courses				
Title		Тур	Hrs/wk	CP
CAE-Team Project (L0271)		Problem-based Learning	2	2
Development of Lightweight Design Produ	cts (L0270)	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 follow	ing learning results		
Professional Competence	After a small all and the small all and the state of the state of			
Knowledge	After completing the module, students are capable of:			
	 explaining the functional principle of 3D-CAD-Systems. describing the interaction of the different CAE-Systems 			
Skilla				
Skills				
	After completing the module, students are able to:			
	evaluate different CAD- and PDM-Systems with regards design an exemplary product using CAD-,PDM- and/or		cation schemes and p	product structuring
Personal Competence				
Social Competence	After completing the module, students are able to:			
	To develop a project plan and allocate work appropriat Present project results as a team for instance in a preservable.		discussions	
Autonomy	Students are capable of:			
	independently adapt to a CAE-Tool and complete a giv	en 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): Specialisation	·		
Curricula	General Engineering Science (German program): Specialisation	* *		
	General Engineering Science (German program, 7 semester):		•	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, I	-ocus Product Devel	opment and Production
	Compulsory General Engineering Science (English program): Specialisation	n Machanical Engineering Focus Aircraft Co	retome Engineering: (Compulsory
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program, 7 semester): \$		•	
	General Engineering Science (English program, 7 semester).		,	, ,
	Compulsory			
	Mechanical Engineering: Specialisation Product Development	and Production: Compulsory		
	Mechanical Engineering: Specialisation Aircraft Systems Engir			
	Product Development, Materials and Production: Technical Co	mplementary Course Core Studies: Elective	Compulsory	



Course L0271: CAE-Team Project	
Тур	Problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause
Language	DE
Cycle	SoSe
Content	 Practical Introduction in the used software systems (Creo, Windchill, Hyperworks) Team formation, allocation of tasks and generation of a project plan Collective creation of one product out of CAD models supported by FEM calculations and PDM system Manufacturing of selected parts using 3D printer Presentation of results Description Part of the module is a project based team orientated practical course using the PBL method. In this course, students learn the handling of modern CAD, PDM and FEM systems (Creo, Windchill and Hyperworks). After a short introduction in the applied software systems, students work in teams on a task during the semester. The aim is the development of one product out of several CAD parts models using a PDM system including FEM calculations of selected parts and 3D printing of parts. The developed product must be presented in a joint presentation.
Literature	•

Course L0270: Development of Light	utweight Design Products
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause
Language	DE
Cycle	SoSe
Content	Lightweight design materials Product development process for lightweight structures Dimensioning of lightweight structures
Literature	 Schürmann, H., "Konstruieren mit Faser-Kunststoff-Verbunden", Springer, Berlin, 2005. Klein, B., "Leichtbau-Konstruktion", Vieweg & Sohn, Braunschweig, 1989. Krause, D., "Leichtbau", In: Handbuch Konstruktion, Hrsg.: Rieg, F., Steinhilper, R., München, Carl Hanser Verlag, 2012. Schulte, K., Fiedler, B., "Structure and Properties of Composite Materials", Hamburg, TUHH - TuTech Innovation GmbH, 2005. Wiedemann, J., "Leichtbau Band 1: Elemente", Springer, Berlin, Heidelberg, 1986.

Course L0269: Integrated Product D	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	СР
Fundamentals of Aircraft Systems (L0741)		Lecture	2	2
Fundamentals of Aircraft Systems (L0742)		Recitation Section (small)	1	1
Air Transportation Systems (L0591)		Lecture	2	2
Air Transportation Systems (L0816)		Recitation Section (large)	1	1
Module Responsible	Prof. Frank Thielecke			
Admission Requirements	none			
Recommended Previous	Basics of mathematics, mechanics and thermodynamics	s		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge	Students get a basic understanding of the structure and	I design of an aircraft, as well as an overview of th	e systems inside an a	ircraft. In addition, a basic
Ü	knowledge of the relationchips, the key parameters, role	es and ways of working in different subsystems in	the air transport is acq	uired.
Skills	Due to the learned cross-system thinking students can gain a deeper understanding of different system concepts and their technical system		d their technical system	
	implementation. In addition, they can apply the learne			•
	context of the overall system.	-	•	,
Personal Competence				
Social Competence	Students are made aware of interdisciplinary communic	cation in groups.		
Autonomy	Students are able to independently analyze different sy	stem concepts and their technical implementation	as well as to think sys	tem oriented.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84		· · · · · · · · · · · · · · · · · · ·	
Credit points	6			
Examination	Written exam			
Examination duration and scale	150 min			
Assignment for the Following	General Engineering Science (German program): Spec	ialisation Mechanical Engineering, Focus Aircraft	Systems Engineering:	Compulsory
Curricula	General Engineering Science (German program, 7 sem	* *		
	General Engineering Science (English program): Speci	, ,	,	. ,
	General Engineering Science (English program, 7 semi			
	Logistics and Mobility: Specialisation Logistics and Mob		,	0 0 11 11 11
1	Mechanical Engineering: Specialisation Aircraft System	·		
	3 3	3 17		

Course L0741: Fundamentals of Air	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	ystems
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Volker Gollnick
Language	DE
Cycle	SoSe
Content	1. Air transport as part of the global transportation system 2. Legal basis of air transportation 3. Safety and security aspects 4. Aircraft basics 5. The role of the aircraft amnufacturer 6. The role of the aircraft operator 7. Airport operation 8. The principles of air traffic management 9. Environmental aspects of air transportation 10. Future perspectives of air transport
Literature	 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 S	Course L0816: Air Transportation Systems		
Тур	Recitation Section (large)		
Hrs/wk	1		
СР	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Prof. Volker Gollnick		
Language	DE		
Cycle	SoSe		
Content	Practical exercises to understand		
	aircraft movement in wind conditions aircraft performance analyses radio navigation prinicples Objective: Understanding and application of principle methods to practical aviation problems		
Literature	Hünnecke: Das moderne Verkehrsflugzeug von heute Flühr: Avionik und Flugsicherungstechnik		



Courses	
Title	Typ Hrs/wk CP
Introduction to Management (L0880)	Lecture 3 3
Project Entrepreneurship (L0882)	Problem-based Learning 2 3
Module Responsible	
Admission Requirements	
Recommended Previous Knowledge	
Educational Objectives	
Professional Competence	
Knowledge	
Skills	 explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions from field of Management explain the most important aspects of and goals in Management and name the most important aspects of entreprneurial projects describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and hum ressource management, information management, innovation management and marketing explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives and uncertainty, and expl some basic methods from mathematical Finance state basics from accounting and costing and selected controlling methods. Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry out Entrepreneurship project in a team. In particular, they are able to analyse Management goals and structure them appropriately analyse organisational and staff structures of companies apply methods for decision making under multiple objectives, under uncertainty and under risk analyse production and procurement systems and Business information systems analyse and apply basic methods from mathematical finance to predefined problems apply basic methods from accounting, costing and controlling to predefined problems
Personal Competence Social Competence	
Autonomy	Students are able to work in a team and to organize the team themselves to write a report on their project.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Examination	Written exam
Examination duration and scale	90 Minuten
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 Bioprocess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Energy and Environmental Engineering: Compulsory
	General Engineering Science (German program): Specialisation Civil- and Environmental Engeneering: Compulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science (Compulsory)
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation 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 Energy and Environmental Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus 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 Alterials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
	Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineeri



Compulsory

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

ompulsory

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

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

Energy and Environmental Engineering: Core qualification: Compulsory

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

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

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

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

 $Technomathematics: Core\ qualification: Compulsory$

Process Engineering: Core qualification: Compulsory



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. Wolfgan
1	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
1	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
ı	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
I	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
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,
	using their knowledge from the corresponding lecture.
	Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Focus Materials in Engineering Sciences

In the specialization "materials in the engineering sciences" the graduates learn how to systematically and methodically analyze and understand fundamental materials-related phenomena. They have broad knowledge of the material science basics of structural and functional materials, including metals, polymers and ceramics. The graduates understand the impact of composition, processing, and service conditions on the material's behavior. Based on this understanding they can assess the suitability of materials for specific technological problems.

Module M0597: Advanced	Mechanical Engineering Design			
Courses				
		Typ	Heat-de	CP
Title		Тур	Hrs/wk	СР
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design	i II (L0265)	Recitation Section (large)	2	1
Advanced Mechanical Engineering Design	ı I (L0262)	Lecture	2	2
Advanced Mechanical Engineering Design	ı I (L0263)	Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
-	Fioi. Dielei Mause			
Admission Requirements	None			
Recommended Previous				
Knowledge	 Fundamentals of Mechanical Engineering Design 			
	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
	Floadction Engineering			
Educational Objectives	After taking part auggestilly at idente have reached the followin	a loorning regulte		
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
_				
	 explain complex working principles and functions of mach 	nine elements and of basic elements of flui	idics,	
	explain requirements, selection criteria, application scena			
			,	
	 indicate the background of dimensioning calculations. 			
Skille	After passing the module, students are able to:			
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of covered machin	e elements		
	-			
	transfer knowledge learned in the module to new requirer	nents and tasks (problem solving skills),		
	 recognize the content of technical drawings and schemati 	c sketches,		
	 evaluate complex designs, technically. 			
Personal Competence				
Social Competence				
Social Competence	 Students are able to discuss technical information in the le 	ecture supported by activating methods.		
Autonomy				
	Students are able to independently deepen their acquired	I knowledge in exercises.		
	 Students are able to acquire additional knowledge and 	I to recapitulate poorly understood conte	ent e.g. by using the	video recordings of th
	lectures.			
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
	· · · · · · · · · · · · · · · · · · ·			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120			
		Machanical Facinaccian Facus Facus C		
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Materials	in Engineering Scier	nces: Compulsory
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			duction: Compulsor:
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering, Foo	us Aircraft Systems E	ingineering: Compulsor
	General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering	g, Focus Materials in	Engineering Science
	Compulsory			
		and all and an American Section of the Section of t	Maabat	
	General Engineering Science (German program, 7 semester): Sp	0 0,		, ,
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering,	Focus Product Deve	lopment and Productio
	Compulsory			
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering	Focus Theoretical I	Mechanical Engineerin
		opeoianoanon meonamear Engineering,	1 0000 THEOTORICAL I	vicenamear Engineemi
	Compulsory			
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering, Foo	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering, Foo	us Energy Systems: 0	Compulsory
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	General Engineering Science (English program): Specialisation is			
	General Engineering Science (English program): Specialisation I	Manhaniani Englishment E		On many vila in the
	General Engineering Science (English program): Specialisation I			
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I	Mechanical Engineering, Focus Materials	in Engineering Scien	
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I	Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro	in Engineering Scien	ces: Compulsory
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I	Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Product D	in Engineering Scien nics: Compulsory revelopment and Prod	duction: Compulsory
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I	Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Product D	in Engineering Scien nics: Compulsory revelopment and Prod	duction: Compulsory
	General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I General Engineering Science (English program): Specialisation I	Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Product D Mechanical Engineering, Focus Theoretic	in Engineering Scien nics: Compulsory levelopment and Prod al Mechanical Engine	duction: Compulsory
	General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Sp	Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Product D Mechanical Engineering, Focus Theoretic ecialisation Mechanical Engineering, Foc	in Engineering Scien nics: Compulsory levelopment and Prod al Mechanical Engine us Aircraft Systems En	duction: Compulsory eering: Compulsory ngineering: Compulsory
	General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Sp. General Engineering Science (English program, 7 semester):	Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Product D Mechanical Engineering, Focus Theoretic ecialisation Mechanical Engineering, Foc	in Engineering Scien nics: Compulsory levelopment and Prod al Mechanical Engine us Aircraft Systems En	duction: Compulsory eering: Compulsory ngineering: Compulsory
	General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Sp. General Engineering Science (English program, 7 semester): Compulsory	Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Product D Mechanical Engineering, Focus Theoretic ecialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering	in Engineering Scien nics: Compulsory levelopment and Prod al Mechanical Engine us Aircraft Systems En I, Focus Materials in	duction: Compulsory duction: Compulsory pering: Compulsory ngineering: Compulsory n Engineering Science
	General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester):	Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Product D Mechanical Engineering, Focus Theoretic ecialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering	in Engineering Scien nics: Compulsory levelopment and Prod al Mechanical Engine us Aircraft Systems En I, Focus Materials in	duction: Compulsory duction: Compulsory pering: Compulsory ngineering: Compulsory n Engineering Science
	General Engineering Science (English program): Specialisation I General Engineering Science (English program, 7 semester): Sp. General Engineering Science (English program, 7 semester): Compulsory	Mechanical Engineering, Focus Materials Mechanical Engineering, Focus Mechatro Mechanical Engineering, Focus Product D Mechanical Engineering, Focus Theoretic ecialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering ecialisation Mechanical Engineering, Focus Mechanical Engineering,	in Engineering Scien nics: Compulsory levelopment and Prod al Mechanical Engine us Aircraft Systems En I, Focus Materials in	duction: Compulsory duction: Compulsory pering: Compulsory ngineering: Compulsory n 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 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		
	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	
	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	WiSe	
Content	Advanced Mechanical Engineering Design I & II	
Content	Advanced Mechanical Engineering Design Facility	
	Lecture	
	Fundamentals of the following machine elements:	
	Linear rolling bearings	
	Axes & shafts	
	Seals	
	Clutches & brakes	
	Belt & chain drives	
	Gear drives	
	Epicyclic gears	
	Crank drives	
	Sliding bearings	
	Elements of fluidics	
	Exercise	
	Calculation methods of the following machine elements:	
	 Linear rolling bearings 	
	Axes & shafts	
	Clutches & brakes	
	Belt & chain drives	
	Gear drives	
	Epicyclic gears	
	Crank gears	
	Sliding bearings Calculations of hydrostatic customs (fluidics)	
	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	
	Sowie weitere Ducher zu Spezienen internen	

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



ourses				_
tle		Тур	Hrs/wk	CP
gnals and Systems (L0432)		Lecture	3	4
gnals and Systems (L0433)		Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch			
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge	The modul is an introduction to the theory of signals and sy	rstems. Good knowledge in maths as covere	d by the moduls Mat	hematik 1-3 is expe
	Further experience with spectral transformations (Fourier seri			
Educational Objectives	After taking part successfully, students have reached the follo	wing learning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and lin			
	to apply the fundamental transformations of continuous-time a			
	and systems mathematically in both time and image domai		in time domain and i	mage domain which
	caused by the transition of a continuous-time signal to a discr			
Skills	The students are able to describe and analyse deterministic	·	-	
	can analyse and design basic systems regarding important p		ponse, stability, linear	rity etc They can as
	the impact of LTI systems on the signal properties in time and	frequency domain.		
Personal Competence				
Social Competence	The students can jointly solve specific problems.			
Autonomy	The students are able to acquire relevant information from a		rol their level of know	rledge during the lea
	period by solving tutorial problems, software tools, clicker sys	tem.		
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			
Curricula	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisat		mpulsory	
	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program, 7 semester)			
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	General Engineering Science (German program, 7 semester)			
	Compulsory	ner). Opeolanisation Meditamedi Engineering	g, rocas materiais ii	. Linginiceting color
	General Engineering Science (German program, 7 semester)	: Specialisation Mechanical Engineering, Foo	cus Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semestry)			
	Compulsory	, specialism modification Engineering	,	
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisati	on Civil- and Enviromental Engeneering: Cor	mpulsory	
	General Engineering Science (English program): Specialisati	on Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisati	on Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisati	on Computer Science: Compulsory		
	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			
	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):			
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	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semes	ier). Specialisation Mechanical Engineering	y, rocus Materials in	ı Engineering Scier
	Compulsory General Engineering Science (English program, 7 semester):	Specialization Machanical Engineering For	ue Machatronias C	nnuleon;
	General Engineering Science (English program, 7 semester): General Engineering Science (English program, 7 semest			
	General Engineering Guence (English program, / semest	or, opeoiansauon mechanical Engineering.	, rocus medielical l	violitatiiloat Ettyittee
	Compulsory			
	Computational Science and Engineering: Core qualification:	Compulsory		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

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



Module M0988: Structural N	Materials			
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Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Mechanical Properties of	Materials (L1090)	Lecture	2	3
Welding Technology (L1123)		Lecture	3	3
Module Responsible	Prof. Claus Emmelmann			
Admission Requirements	None			
Recommended Previous	Fundamentals of Materials Science			
Knowledge				
Educational Objectives	After taking part successfully, students have reache	d the following learning results		
Professional Competence				
Knowledge	The students get to know the principles that are re-	sponsible for the mechanical behaviour of metals.	They acquire basic knowl	egde in modelling of the
	materials behaviour. Furthermore, the students lea	rn about the behaviour of metals under static and	dynamic loads. The stude	nts get to know the most
	important welding technologies and the correspond	ling systems. They learn about the influence of wel	ding on the materials and	design.
Skills	The students know the mechanical properties of r	netals and the underlying principles. They are ab	le to name the influencin	a factors on the welding
Okino	The students know the mechanical properties of metals and the underlying principles. They are able to name the influencing factors on the welding behaviour of steel materials.			
	The students are able to select between alloys according to the desired mechaincal properties and welability. They can distinguish between different			
	welding techniques and select the suitable technique and system components for a defined application. They are able to dimension weld joints within			
	design tasks.			
Personal Competence				
Social Competence	none			
Autonomy	none			
Workload in Hours	Independent Study Time 110, Study Time in Lecture	e 70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): S	Specialisation Mechanical Engineering, Focus Mate	rials in Engineering Scier	ices: Compulsory
Curricula	General Engineering Science (German program,	7 semester): Specialisation Mechanical Engine	ering, Focus Materials in	Engineering Sciences:
	Compulsory			
	General Engineering Science (English program): S	pecialisation Mechanical Engineering, Focus Mate	rials in Engineering Scien	ces: Compulsory
	General Engineering Science (English program,	7 semester): Specialisation Mechanical Engine	ering, Focus Materials in	Engineering Sciences:
	Compulsory			
	Mechanical Engineering: Specialisation Materials i	n Engineering Sciences: Compulsory		

	Course L1090: Fundamentals of Mechanical Properties of Materials	
	Lecture	
Hrs/wk	2	
СР	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)	
	N.Huber: Scriptum "Materialtheorie" Uni Karlsruhe (1998)	
	P. Haupt: Cont. Mechanics and Theory of Materials (2002)	



Course L1123: Welding Technology	
Тур	Lecture
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Claus Emmelmann, Prof. Karl-Ulrich Kainer
Language	DE
Cycle	WiSe
Content	- phase transitions, phase diagrams and thermal activated processes
	- fundamentals of steels, heat treatment applications for steels and time temperature transformation diagrams
	- properties of weldable carbon and fine grained steels
	- properties of weldable low- and high-alloy steels, corrosion resistant steels and high-strength steels
	- structure and properties of non-ferrite metals (aluminum, titanium)
	- NDT/DT Methods for materials and welds
	- gas fusion welding, fundamentals of electric arc welding technologies
	- structure and influence parameters for the welded joint
	- submerged arc welding/tungsten inert gas welding/inert gas metal arc welding (MIG)/active gas metal arc welding (MAG)/Plasma Welding
	- resistance welding/ polymer welding/ hybrid-welding
	- deposition welding
	- electron beam welding/ laser beam welding
	- weld joint designs and declarations
	- computation methods for weld joint dimensioning
Literature	Schulze, G.: Die Metallurgie des Schweißens, 4. Aufl., Berlin 2010 Strassburg, F.W. und Wehner H.: Schweißen nichtrostender Stähle, 4. Aufl.
	Düsseldorf, 2009 Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 1: Schweiß- und Schneidtechnologien, 3. Aufl., Berlin 2006.
	Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 2: Verhalten der Werkstoffe beim Schweißen, 3. Aufl., Berlin 2005.
	Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 3: Gestaltung und Festigkeit von Schweißkonstruktionen, 2. Aufl., Berlin 2002.



Courses				
tle		Тур	Hrs/wk	СР
umerical Mathematics I (L0417)		Lecture	2	3
umerical Mathematics I (L0418)		Recitation Section (small)	2	3
Module Responsible	Prof. Sabine Le Borne			
Admission Requirements	None			
Recommended Previous Knowledge	Mathematik I + II for Engineering Students (german or er basic MATLAB knowledge	glish) or Analysis & Linear Algebra I + II foi	Technomathematicia	ns
Educational Objectives	After taking part successfully, students have reached the following	ng 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 metho explain aspects for the practical execution of numerical relationships.	ds,		finding problems and
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 given	with respect to the problem and solution al	gorithm,	
Personal Competence Social Competence	Students are able to			
	work together in heterogeneously composed teams (i.e foundations and support each other with practical aspec			dge), explain theoret
Autonomy	Students are capable			
	to assess whether the supporting theoretical and practic. to assess their individual progess and, if necessary, to a		or in a team,	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation	n Computer Science: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Biomech	anics: Compulsory	
	General Engineering Science (German program): Specialisation	n Mechanical Engineering, Focus Materials	in Engineering Scien	ces: Compulsory
	General Engineering Science (German program): Specialisation	Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): S	pecialisation Computer Science: Compulso	ory	
	General Engineering Science (German program, 7 semester	:): Specialisation Mechanical Engineering	g, Focus Materials in	Engineering Science
	Compulsory			
	General Engineering Science (German program, 7 semester): S	pecialisation Biomedical Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semester): S		us Biomechanics: Co	mpulsory
	Bioprocess Engineering: Specialisation A - General Bioprocess			
	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			
	General Engineering Science (English program): Specialisation		-	ces: Compulsory
	General Engineering Science (English program, 7 semester): S	·	-	Engineering Coine
	General Engineering Science (English program, 7 semester Compulsory	7. Specialisation Mechanical Engineering	, rocus Maleriais in	Lingineering Science
	General Engineering Science (English program, 7 semester): S	pecialisation Biomedical Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester): S			npulsory
	Computational Science and Engineering: Core qualification: Co			



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
Language	DE
Cycle	WiSe
Content	 Error analysis: Number representation, error types, conditioning and stability Interpolation: polynomial and spline interpolation Numerical integration and differentiation: order, Newton-Cotes formula, error estimates, Gaussian quadrature, adaptive quadrature, difference formulas Linear systems: LU and Cholesky factorization, matrix norms, conditioning Linear least squares problems: normal equations, Gram.Schmidt and Householder orthogonalization, singular value decomposition, regularization Eigenvalue problems: power iteration, inverse iteration, QR algorithm Nonlinear systems of equations: Fixed point iteration, root-finding algorithms for real-valued functions, Newton and Quasi-Newton methods for systems
Literature	Stoer/Bulirsch: Numerische Mathematik 1, Springer Dahmen, Reusken: Numerik für Ingenieure und Naturwissenschaftler, Springer

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



Module M1009: Material Sc	ience Laboratory			
0				
Courses				
Title	1.1	Тур	Hrs/wk	CP
Companion Lecture for Materials Science Material Science Laboratory (L1235)	Laboratory (L1088)	Lecture Laboratory Course	2 4	2
	Prof. Bodo Fiedler	Laboratory Course	4	4
Module Responsible Admission Requirements	none			
Recommended Previous	none			
Knowledge	Tions			
Educational Objectives	After taking part successfully, students have reached the followin	g learning results		
Professional Competence				
Knowledge	Students are able to give a summary of the technical details of ea	xperiments in the area of materials scie	nces and illustrate respe	ctive relationships. They
	are capable of describing and communicating relevant probler	•	•	
	process of solving practical problems and present related results		0 0 ,	, ,,
Skills	The students can transfer their fundamental knowledge on mate		practical problems. The	y identify and overcome
	typical problems during the realization of experiments in the cont	ext of material sciences.		
Personal Competence				
Social Competence	Students are able to cooperate in small groups in order to condu	uct experiments in the context of materi	als sciences. They are a	ble to effectively present
	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 mate	erials sciences using provided literatur	re. They are able to fill o	ans in as well as extent
nationomy	their knowledge using the literature and other sources provided by		ic. They are able to lin g	apo in ao won ao extent
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84	.,		
Credit points	6			
Examination	Colloquium			
Examination duration and scale	1,5 h written Exam (50%) covering the lesson			
Assignment for the Following	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Materi	als in Engineering Scien	ces: Compulsory
Curricula	General Engineering Science (German program): Specialisation	* *		
	General Engineering Science (German program, 7 semester)			
	Compulsory	,	0,	
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Materia	als in Engineering Scien	ces: Compulsory
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Produc	t Development and Proc	luction: Compulsory
	General Engineering Science (English program, 7 semester)	: Specialisation Mechanical Engineer	ing, Focus Materials in	Engineering Sciences:
	Compulsory			
	Mechanical Engineering: Specialisation Product Development at	nd Production: Compulsory		
	Mechanical Engineering: Specialisation Materials in Engineering	Sciences: Compulsory		
	Product Development, Materials and Production: Technical Com	plementary Course Core Studies: Electi	ive Compulsory	

Course L1088: Companion Lecture	·
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	poratory
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



ourses			
tle	Тур	Hrs/wk	CP
roduction to Control Systems (L0654) roduction to Control Systems (L0655)	Lecture Recitation Section (small)	2	4 2
Module Responsible			_
Admission Requirements			
Recommended Previous			
Knowledge			
_			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge			
	Students can represent dynamic system behavior in time and frequency domain, and can in particu .	lar explain properties	s of first and second or
	systems	fraguanay raananaa a	and root loous
	 They can explain the dynamics of simple control loops and interpret dynamic properties in terms of They can explain the Nyquist stability criterion and the stability margins derived from it. 	requency response a	and root locus
	They can explain the role of the phase margin in analysis and synthesis of control loops		
	They can explain the vay 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 impleme	nted digitally	
		0 ,	
Skills	 Students can transform models of linear dynamic systems from time to frequency domain and vice v 	rersa	
	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 res	ponse techniques	
	They can calculate discrete-time approximations of controllers designed in continuous-time and use		entation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these task	s	
Personal Competence			
Social Competence		•	
Autonomy		ment guides) and us	se it when solving giv
	problems.		
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.		
Workload in Hours			
Credit points	6		
Credit points Examination	Written exam		
Credit points Examination Examination duration and scale	Written exam 120 min		
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory		
Credit points Examination Examination duration and scale	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsor	•	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Con	npulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsor	npulsory ory	
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulso General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsor	npulsory ory ry	
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsor General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Comp General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compu General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compu General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foc	npulsory bry ry inulsory inpulsory gineering: Compulsor ilsory us Mechatronics: Cor us Biomechanics: Cor	mpulsory ompulsory
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsor General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Con General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsor General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsor General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Comp General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Com General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compu General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foc General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Compulsory	npulsory ry pulsory npulsory gineering: Compulsor ulsory sus Mechatronics: Con sus Biomechanics: Con sus Aircraft Systems E g, Focus Materials in Focus Theoretical I	mpulsory compulsory co
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General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

se L0654: Introduction to Contr	o systems	
Тур	Lecture	
Hrs/wk	2	
СР	4	
Workload in Hours	ndependent Study Time 92, Study Time in Lecture 28	
Lecturer	Prof. Herbert Werner	
Language	DE	
Cycle	WiSe	
Content	Signals and systems	
	Linear such and differential associations and benefit stations	
	 Linear systems, differential equations and transfer functions First and second order systems, poles and zeros, impulse and step response 	
	Stability	
	• Stability	
	Feedback systems	
	Principle of feedback, open-loop versus closed-loop control	
	Reference tracking and disturbance rejection	
	Types of feedback, PID control	
	System type and steady-state error, error constants	
	Internal model principle	
	Root locus techniques	
	Root locus plots	
	Root locus design of PID controllers	
	Frequency response techniques	
	Bode diagram	
	Minimum and non-minimum phase systems	
	Nyquist plot, Nyquist stability criterion, phase and gain margin	
	Loop shaping, lead lag compensation	
	Frequency response interpretation of PID control	
	Time delay systems	
	Root locus and frequency response of time delay systems	
	Smith predictor	
	Digital control	
	Sampled-data systems, difference equations	
	Tustin approximation, digital implementation of PID controllers	
	Software tools	
	Introduction to Matlab, Simulink, Control toolbox	
	Computer-based exercises throughout the course	
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"	
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009	
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010	
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010	



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



Courses				
Title		ур	Hrs/wk	CP
Computer Engineering (L0321) Computer Engineering (L0324)		ecture ecitation Section (small)	3 1	4
Module Responsible	Prof. Heiko Falk	ectation Section (smail)	ı	2
Admission Requirements	None			
Recommended Previous				
Knowledge				
	The successful completion of the labs will be honored during the evaluation o	f the module's examination a	ccording to the following	ng rules:
	Upon a passed module examination, the student is granted a bone	us on the examination's ma	rks due to the succes	ssful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the nex	t-better grade.		
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not p	possible.		
Educational Objectives	After taking part successfully, students have reached the following learning re	culte		
Professional Competence	After taking part successionly, students have reached the following realiting re	outo .		
Knowledge	This module deals with the foundations of the functionality of computing sy	stems. It covers the lavers fr	om the assembly-leve	el programming down
rtnowicago	gates. The module includes the following topics:	sterne. It develo the layers if	om the assembly leve	or programming down
	ganes are marked and and any are			
	Introduction			
	Combinational logic: Gates, Boolean algebra, Boolean functions, hard	ware synthesis, combination	al networks	
	Sequential logic: Flip-flops, automata, systematic hardware design			
	Technological foundations Computer arithmetic: Integer addition, subtraction, multiplication and d	ivinion		
	 Computer arithmetic: Integer addition, subtraction, multiplication and d Basics of computer architecture: Programming models, MIPS single-cy 			
	Memories: Memory hierarchies, SRAM, DRAM, caches	cie arcintecture, pipenning		
	Input/output: I/O from the perspective of the CPU, principles of passing	data, point-to-point connection	ons, busses	
		, p	,	
Skills	The students perceive computer systems from the architect's perspective,			
	computer systems. The students can analyze, how highly specific and ind	ividual computers can be b	uilt based on a colle	ction of few and sim
	components. They are able to distinguish between and to explain the different	nt abstraction layers of today	's computing systems	- from gates and circi
	up to complete processors.			
	After successful completion of the module, the students are able to judge the	interdependencies between	a physical computer	system and the softwa
	executed on it. In particular, they shall understand the consequences that the	execution of software has o	n the hardware-centri	c abstraction layers fr
	the assembly language down to gates. This way, they will be enabled to evalu	uate the impact that these lov	v abstraction levels ha	ave on an entire syste
	performance and to propose feasible options.			
Davasual Commetence				
Personal Competence Social Competence	Students are able to colve similar problems clane or in a group and to present	t the recults accordingly		
Social Competence	Students are able to solve similar problems alone or in a group and to presen	tine results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific literature and to as	sociate this knowledge with o	ther classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
	Independent Study Time 124, Study Time in Lecture 56			
Workload in Hours Credit points Examination				
Credit points Examination	6 Written exam			
Credit points Examination Examination duration and scale	6 Written exam 90 minutes, contents of course and labs	SOLA		
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compuls	•	DIV	
Credit points Examination Examination duration and scale	6 Written exam 90 minutes, contents of course and labs	Computer Science: Compuls	•	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compuls General Engineering Science (German program, 7 semester): Specialisation	Computer Science: Compuls Bioprocess Engineering: Cor	npulsory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compuls General Engineering Science (German program, 7 semester): Specialisation General Engineering Science (German program, 7 semester): Specialisation	Computer Science: Compuls Bioprocess Engineering: Cor Naval Architecture: Compulsi	npulsory ory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Computs General Engineering Science (German program, 7 semester): Specialisation General Engineering Science (German program, 7 semester): Specialisation General Engineering Science (German program, 7 semester): Specialisation	Computer Science: Compuls Bioprocess Engineering: Cor Naval Architecture: Compuls Civil Engineering: Compulso	npulsory ory ry	
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compute General Engineering Science (German program, 7 semester): Specialisation	Computer Science: Compulss Bioprocess Engineering: Cor Naval Architecture: Compulso Civil Engineering: Compulso Civil Engineering: Compulso Biomedical Engineering: Cornective Energy and Environmental En Process Engineering: Computer Science Engineering: Computer Engin	npulsory ory ry nulsory npulsory gineering: Compulsory ilsory sus Mechatronics: Con sus Biomechanics: Con sus Aircraft Systems Er	npulsory mpulsory ngineering: Compulso
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Technomathematics: Specialisation II. Informatics: Elective Compulsory



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

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

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
	Time to mand
	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 shifte
- 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
- 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 M1005: Enhanced I	Fundamentals of Materials Science			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Metallic Materials (L1086		Lecture	2	3
Fundamentals of Ceramic and Polymer Materials (L1233) Lecture		2	2	
Fundamentals of Ceramic and Polymer Ma				
	Prof. Gerold Schneider			
Admission Requirements	None			
Recommended Previous	Module "Fundamentals of Materials Science"			
Knowledge	Module "Materials Science Laboratory"			
	Module "Advanced Materials"			
Educational Objectives	After taking part successfully, students have reached	I the following learning results		
Professional Competence				
Knowledge	The students are able to give an enhanced overview	over the following topics		
	in metals, polymers and ceramics: Atomic bonds, of	rystal and amorphous structures, defects	, electrical and mass transport	, microstructure and phase
	diagrams. They are capable to explain the correspo	nding technical terms.		
Skills	The students are able to apply the appropriate phys	cal and chemical methods for the above n	nentioned subjects.	
Personal Competence				
Social Competence				
Autonomy	The students are capable to understand independently the structure and propeties of ceramics, metals and polymers. They should be able to critally			
	evaluate the profoundness of their knowledge.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture	70		
Credit points	6			
Examination	Written exam			
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): S	pecialisation Mechanical Engineering Foo	us Materials in Engineering Sc	iences: Compulsorv
Curricula	General Engineering Science (German program,			
34	Compulsory		g	5
	General Engineering Science (German program, 7	semester): Specialisation Mechanical Fi	naineerina. Focus Product De	velopment and Production:
	Compulsory	, -p	3 ,	
	General Engineering Science (English program): Sp	ecialisation Mechanical Engineering Foci	us Materials in Engineering Sci	ences: Compulsorv
	General Engineering Science (English program,	-		
	Compulsory		5	
	General Engineering Science (English program, 7	semester): Specialisation Mechanical Er	naineerina, Focus Product De	velopment and Production:
	Compulsory	Strip op 1 and 1 a	J	
	Mechanical Engineering: Specialisation Materials in	Engineering Sciences: Compulsory		
	Technomathematics: Specialisation III. Engineering			
	Technomathematics: Core qualification: Elective Co	' '		
		F 7		

Course L1086: Fundamentals of Metallic Materials		
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		
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 L1233: Fundamentals of Cer	
Тур	Lecture
Hrs/wk	
CP	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28 Prof. Gerold Schneider, Prof. Bodo Fiedler
Lecturer Language	DE/EN
Cycle	SoSe
Content	1. Einführung
Content	The Embracies
	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
	r uveraulbereitung
	Mahltechnik
	Sprühtrockner
	3. Formgebung
	Arten der Formgebung Pressen (0 - 15 % Feuchte)
	Gießen (> 25 % Feuchte)
	Plastische Formgebung (15 - 25 % Feuchte)
	4. Sintern
	Triebkraft des Sinterns
	Effekt von gekrümmten Oberflächen und Diffusionswegen
	Sinterstadien des isothermen Festphasensinterns
	Herring scaling laws Heißisostatisches Pressen
	Reinsosalisches Flessen
	5. Mechanische Eigenschaften von Keramiken
	Elastisches und plastisches Materialverhalten
	Bruchzähigkeit – Linear-elastische Bruchmechanik
	Festigkeit - Festigkeitsstreuung
	6. Elektrische Eigenschaften von Keramiken
	S. Elokulotio Elgonotiatori von Kolanikon
	Ferroelektische Keramiken
	Piezo-, ferroelektrische Materialeigenschaften
	Anwendungen
	Keramische Ionenleiter
	Ionische Leitfähigkeit
	Dotiertes Zirkonoxid in der Brennstoffzelle und Lambdasonde
Literature	D R H Jones, Michael F. Ashby, Engineering Materials 1, An Introduction to Properties, Applications and Design, Elesevier
	D.W. Richerson, Modern Ceramic Engineering, Marcel Decker, New York, 1992
	W.D. Kingery, Introduction to Ceramics, John Wiley & Sons, New York, 1975
	D.J. Green, An introduction to the mechanical properties of ceramics", Cambridge University Press, 1998
	D. Munz, T. Fett, Ceramics, Springer, 2001
	Polymerwerkstoffe
	Struktur und mechanische Eigenschaften G.W.Ehrenstein;
	Hanser Verlag; ISBN 3-446-12478-0; ca. 20 €
	Kunststoffphysik
	W.Retting, H.M.Laun; Hanser Verlag; ISBN 3446162356; ca. 25 €
	Werkstoffkunde Kunststoffe G.Menges; Hanser Verlag; ISBN 3-446-15612-7; ca. 25 €
	Samongoo, nanoor toriag, robito 470 10012 1, ou. 20 C
	Kunststoff-Kompendium
	A.Frank, K. Biederbick; Vogel Buchverlag; ISBN 3-8023-0135-8; ca.30 €



Course L1234: Fundamentals of Ceramic and Polymer Materials		
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	



Module M0829: Foundation				
ourses				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880) roject Entrepreneurship (L0882)		Lecture Problem-based Learning	3	3
Module Responsible	Prof. Christoph Ihl	Troblem-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 following learning	results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of many differ Marketing and Innovation, and also to Investment and Controlling. In partic		nagement, from Plani	ning and Organisation
	explain the differences between Economics and Management and	the sub-disciplines in Managem	nent and to name impo	ortant definitions from t
	field of Management	day and the man Day and and a second		
	 explain the most important aspects of and goals in Management an describe and explain basic business functions as production, pro 			
	ressource management, information management, innovation man		chair management,	ngamzation and num
	explain the relevance of planning and decision making in Busine		Iltiple objectives and	uncertainty, and expla
	some basic methods from mathematical Finance			
	state basics from accounting and costing and selected controlling in	nethods.		
Skills	Students are able to analyse business units with respect to differe Entrepreneurship project in a team. In particular, they are able to	nt criteria (organization, object	ctives, strategies etc) and to carry out
	analyse Management goals and structure them appropriately			
	analyse management goals and structure them appropriately analyse organisational and staff structures of companies			
	apply methods for decision making under multiple objectives, under	r uncertainty and under risk		
	analyse production and procurement systems and Business inform			
	analyse and apply basic methods of marketing			
	select and apply basic methods from mathematical finance to prede	efined problems		
	apply basic methods from accounting, costing and controlling to pre	edefined problems		
Personal Competence				
Social Competence	Students are able to			
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepreneurship pr	oject 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				
Curricula				
	General Engineering Science (German program): Specialisation Process I General Engineering Science (German program): Specialisation Bioproce			
	General Engineering Science (German program): Specialisation Energy a		ompulsory	
	General Engineering Science (German program): Specialisation Civil- and	I Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (German program): Specialisation Mechanic	cal Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Biomedic			
	General Engineering Science (German program): Specialisation Naval Arc			
	General Engineering Science (German program, 7 semester): Specialisati General Engineering Science (German program, 7 semester): Specialisati			
	General Engineering Science (German program, 7 semester): Specialisation		•	
	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Specialisati	•	•	
	General Engineering Science (German program, 7 semester): Specialisation	on Bioprocess Engineering: Cor	mpulsory	
	General Engineering Science (German program, 7 semester): Specialisation	on Civil Engineering: Compulso	ry	
	General Engineering Science (German program, 7 semester): Specialisati			
	General Engineering Science (German program, 7 semester): Specialisation			
	General Engineering Science (German program, 7 semester): Specialisati General Engineering Science (German program, 7 semester): Specialisati	-		
	General Engineering Science (German program, 7 semester): Specialisation General Engineering Science (German program, 7 semester): Specialisation	-	-	
	Compulsory	Engineering	,	
	General Engineering Science (German program, 7 semester): Specialis	sation Mechanical Engineering	, Focus Theoretical M	Mechanical Engineeri
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Compulsory

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

ompulsory

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

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

Energy and Environmental Engineering: Core qualification: Compulsory

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

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

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

Technomathematics: Core qualification: Compulsory



	Lasteria	
Тур	Lecture	
	3	
	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. Wolfg	
1	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona DE	
Language Cycle	WiSe/SoSe	
Content	WIDE/JODE	
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 Associated Planning Tasks, e.g. Investment and Financial Decisions	
	Introduction to Accounting: Accounting, Balance-Sheets, Costing Palances of Costalling and calcut di Costalling pathods.	
	Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects	
	Important aspects or Entrepreneutship 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
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept, using their knowledge from the corresponding lecture. Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Focus Mechatronics

In the focus "Mechatronics" students learn next to the knowledge and skills of mechanical engineering deeper knowledge and skills of electrical and mechatronics engineering and are therefore able to solve interdisciplinary problems in mechatronics, those sub-disciplines and related disciplines.

Module M0597: Advanced	Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	CP
Advanced Mechanical Engineering Design Advanced Mechanical Engineering Design		Lecture Recitation Section (large)	2	2
				2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Module Responsible				
Admission Requirements	None			
Recommended Previous				
Knowledge	Fundamentals of Mechanical Engineering Design			
Moneage	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the following	loarning regulte		
	Alter taking part successionly, students have reached the following	learning results		
Professional Competence	After a conjugation and the state of the sta			
Knowledge	After passing the module, students are able to:			
	explain complex working principles and functions of machi	ne elements and of basic elements of fl	uidics,	
	explain requirements, selection criteria, application scenar	ios 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 requirem			
	recognize the content of technical drawings and schematic	sketches,		
	evaluate complex designs, technically.			
Personal Competence				
Social Competence	Students are able to discuss technical information in the least	cture supported by activating methods.		
Autonomy	Students are able to independently deepen their acquired	knowledge in evercises		
	Students are able to independently deepen their acquired Students are able to acquire additional knowledge and		tent e.a. by using the	video recordings of t
	lectures.	to recapitalate poorly understood con	iterit e.g. by using the	video recordings or i
	rectures.			
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 M	Mechanical Engineering, Focus Energy	Systems: Compulsory	
Curricula	General Engineering Science (German program): Specialisation M	Mechanical Engineering, Focus Aircraft	Systems Engineering:	Compulsory
	General Engineering Science (German program): Specialisation M	Mechanical Engineering, Focus Materia	ls in Engineering Scier	ices: Compulsory
	General Engineering Science (German program): Specialisation M	Mechanical Engineering, Focus Mechat	ronics: Compulsory	
	General Engineering Science (German program): Specialisation M	Mechanical Engineering, Focus Product	Development and Pro	duction: Compulsory
	General Engineering Science (German program): Specialisation M	Mechanical Engineering, Focus Theoret	tical Mechanical Engine	eering: Compulsory
	General Engineering Science (German program, 7 semester): Spe	ecialisation Mechanical Engineering, Fo	ocus Aircraft Systems E	ngineering: Compulso
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering	ng, Focus Materials in	Engineering Science
	Compulsory			
	General Engineering Science (German program, 7 semester): Spe	ecialisation Mechanical Engineering, Fo	ocus Mechatronics: Cor	npulsory
	General Engineering Science (German program, 7 semester): S	Specialisation Mechanical Engineering	, Focus Product Devel	opment and Production
	Compulsory			
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering	g, Focus Theoretical M	Mechanical Engineerii
	Compulsory			
	General Engineering Science (German program, 7 semester): Spe	ecialisation Mechanical Engineering, Fo	ocus Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory			
	General Engineering Science (English program): Specialisation M	lechanical 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 M	lechanical Engineering, Focus Mechatr	onics: Compulsory	
	General Engineering Science (English program): Specialisation M	lechanical Engineering, Focus Product	Development and Prod	duction: Compulsory
	General Engineering Science (English program): Specialisation M	lechanical Engineering, Focus Theoreti	cal Mechanical Engine	ering: Compulsory
	General Engineering Science (English program, 7 semester): Spe	cialisation Mechanical Engineering, Fo	cus Aircraft Systems Er	ngineering: Compulsor
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering	ng, 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): Spe	cialisation Mechanical Engineering, Fo	cus Mechatronics: Con	npulsory
	General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): S			



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		
=1.0.414.0	 Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. 	
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.	
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.	
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.	
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.	
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.	
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.	
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.	
	Sowie weitere Bücher zu speziellen Themen	

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



Course L0262: Advanced Mechanic	al Engineering Design I
	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	Advanced Mechanical Engineering Design I & II
Content	Advanced mechanical Engineering Design (& 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.
	On the section District Control of the Theory
	Sowie weitere Bücher zu speziellen Themen

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



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



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

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



Module M0708: Electrical E	ngineering III: Circuit Theory and Transients			
Courses				
Title		Тур	Hrs/wk	СР
Circuit Theory (L0566)		Lecture	3	4
Circuit Theory (L0567)		Recitation Section (small)	2	2
Module Responsible	Prof. Arne Jacob			
Admission Requirements	none			
Recommended Previous	Electrical Engineering I and II, Mathematics I and II			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	Students are able to explain the basic methods for calculati periodic signals. They know the methods for transient analy frequency behaviour and the synthesis of passive two-terminal	sis of linear networks in time and in freque		
Skills	The students are able to calculate currents and voltages in linable to calculate transients in electrical circuits in time and free analyse and to synthesize the frequency behaviour of passive	quency domain and are able to explain the i		
Personal Competence Social Competence	Students work on exercise tasks in small guided groups. They	rare encouraged to present and discuss the	ir results within the ara	un
Autonomy	The students are able to find out the required methods for so lectures continuously by means of short-time tests. This allow knowledge to other courses like Electrical Engineering I and N	ws them to control independently their edu		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
	Willell exalli			
Examination duration and scale	0	See Florida I Feeders day Occasion		
Assignment for the Following Curricula				
Curricula	General Engineering Science (German program): Specialisati General Engineering Science (German program, 7 semester):			nnulcon
	General Engineering Science (German program, 7 semester):			приготу
	Electrical Engineering: Core qualification: Compulsory	. oposiansanon Electrical Engineering. Com	paisory	
	General Engineering Science (English program): Specialisation	on Flectrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation		onics: Compulsory	
	General Engineering Science (English program, 7 semester):			npulsorv
	General Engineering Science (English program, 7 semester):			.pu.0019
	Computational Science and Engineering: Specialisation Engi		· · · · · · ·	
	Mechatronics: Core qualification: Compulsory	5		
		51 · · · · · · · · ·		
	Technomathematics: Specialisation III. Engineering Science: I	Elective Compulsory		



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

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



Module M1320: Simulation	and Design of Mechatronic Systems			
Courses				
Title		Тур	Hrs/wk	CP
Simulation and Design of Mechatronic Syst		Lecture	2	2
Simulation and Design of Mechatronic Syst		Laboratory	1	2
Simulation and Design of Mechatronic Syst		Recitation Section (large)	1	2
Module Responsible				
· ·	None			
Recommended Previous	Fundatmentals of mechanics, control theory and electrical engineer	ng		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning to the students have reached the students hav	earning results		
Professional Competence				
Knowledge	Students are able to describe methods and calculations for design,	modeling, simulation and optimization	of mechatronic systen	ns.
Chille	Children are alle to analy modern alreadings for modeling of			::
Skills	Students are able to apply modern algorithms for modeling of n	lechaironic systems. They can identi	ny, simulate and des	ign simple systems and
	implement those in laboratory conditions.			
Personal Competence				
Social Competence	Students are able to work goal-oriented in small mixed groups and p	present results to target groups.		
Autonomy	Students are able to recognize and improve knowledge deficits independently.			
	With instructor assistance, students are able to evaluate their own knowledge level and define a further course of study.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Mechatro	onics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Aircraft S	Systems Engineering:	Compulsory
	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Theoretic	cal Mechanical Engine	eering: Compulsory
	General Engineering Science (German program, 7 semester): Spec	alisation Mechanical Engineering, Foo	cus Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory			
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:			
	Elective Compulsory			
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory			
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory			
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical 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 Aircraft Systems Engineering: Compulsory			
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:			
	Elective Compulsory			
	Mechanical Engineering: Specialisation Aircraft Systems Engineering	g: Compulsory		
	Mechanical Engineering: Specialisation Mechatronics: Compulsory	•		
	Mechanical Engineering: Specialisation Theoretical Mechanical Engineering	gineering: Compulsory		
	Mechatronics: Core qualification: Compulsory			
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Course L1822: Simulation and Design of Mechatronic Systems		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	Mechatronic Design	
	Modeling	
	Model Identifikation	
	Numerical Methods in simulation	
	Applications and examples in Matlab [®] and Simulink [®]	
Literature	Skript zur Veranstaltung	
	Weitere Literatur in der Veranstaltung	



Course L1824: Simulation and Design of Mechatronic Systems		
Тур	Laboratory	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1823: Simulation and Design 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	



ourses		
itle	Typ Hrs/wk	CP
omputer Engineering (L0321) omputer Engineering (L0324)	Lecture 3 Recitation Section (small) 1	4
Module Responsible		
Admission Requirements		
Recommended Previous		
Knowledge		
	The successful completion of the labs will be honored during the evaluation of the module's examination according to the following	g rules:
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the success	sful labs, such that t
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.	
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge		programming down
Knowledge	gates. The module includes the following topics:	programming down
	gates. The module molades are following topics.	
	Introduction	
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks	
	Sequential logic: Flip-flops, automata, systematic hardware design	
	Technological foundations	
	Computer arithmetic: Integer addition, subtraction, multiplication and division Proved for the provided AMPO in the provided AMPO	
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining	
	Memories: Memory hierarchies, SRAM, DRAM, caches Application of the control of the CRIA principles of control of the con	
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the p	hysical composition
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a collect	tion 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 circu
	up to complete processors.	
	After successful completion of the module, the students are able to judge the interdependencies between a physical computer sy	vetem and the coffw
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-centric	
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels have	
		o on an onero oyoto.
	performance and to propose feasible options.	
	performance and to propose feasible options.	
Personal Competence		
Personal Competence Social Competence		
Social Competence	Students are able to solve similar problems alone or in a group and to present the results accordingly.	
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Social Competence	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.	
Social Competence Autonomy	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56	
Social Competence Autonomy Workload in Hours	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56	
Social Competence Autonomy Workload in Hours Credit points	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam	
Social Competence Autonomy Workload in Hours Credit points Examination	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	
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Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Disprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Disprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Com General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Com General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Com General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatrolas in Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Meterals in Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Develor Compulsory General Engine	pulsory gineering: Compulso Engineering Scienc echanical Engineeri pment and Producti
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Technomathematics: Specialisation II. Informatics: Elective Compulsory



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

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

Hrs/wk	
60	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



- 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 shifte
- 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
- 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



Courses		
itle	Typ Hrs/wk CP Lecture 2 4	
ntroduction to Control Systems (L0654) ntroduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2	
Module Responsible		
Admission Requirements		
Recommended Previous		
Knowledge		
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and	l cocond ord
	Statuents can represent dynamic system behavior in time and nequency domain, and can in particular explain properties of instantic systems	i secona ora
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root loc	cus
	They can explain the Nyquist stability criterion and the stability margins derived from it.	
	They can explain the role of the phase margin in analysis and synthesis of control loops	
	They can explain the way a PID controller affects a control loop in terms of its frequency response	
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally	
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 The control of NP control of the c	
	 They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques 	
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation	
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks	
Personal Competence		
Social Competence		
Autonomy		solving give
	problems.	
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Workload in Hours Credit points		
	6	
Credit points	6 Written exam	
Credit points Examination	6 Written exam 120 min	
Credit points Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory	
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer 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: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory	ring Science I Engineerin
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualif	ring Science I Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Daval Architecture: Compulsory General Engineering Science (German program, 7 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 Brocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering 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 Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsor	ring Science I Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Dioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus 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 General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development an Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Ceneral Engine	ring Science I Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 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 Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program	ring Science I Engineerin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 Aircraft Systems Engineering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineer Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development an Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development an Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Sci	ring Science Engineering
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 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 Product Development and Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program	ring Science I Engineerin



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

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

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

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

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

se L0654: Introduction to Contr	o systems
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems
	Linear such and differential associations and benefit stations
	 Linear systems, differential equations and transfer functions First and second order systems, poles and zeros, impulse and step response
	Stability
	• Stability
	Feedback systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Root locus techniques
	Root locus plots
	Root locus design of PID controllers
	Frequency response techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation
	Frequency response interpretation of PID control
	Time delay systems
	Post logic and frequency recognics of time delay cycloms
	Root locus and frequency response of time delay systems Smith predictor
	- Office productor
	Digital control
	Sampled-data systems, difference equations
	Tustin approximation, digital implementation of PID controllers
	Software tools
	Introduction to Matlab, Simulink, Control toolbox
	Computer-based exercises throughout the course
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010



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



Module M0777: Semicondu	uctor Circuit Design			
0				
Courses				
Fitle		Тур	Hrs/wk	СР
Semiconductor Circuit Design (L0763) Semiconductor Circuit Design (L0864)		Lecture Recitation Section (small)	3 1	2
Module Responsible	Prof. Wolfgang Krautschneider	Treditation decision (small)	'	
-				
Admission Requirements	none			
Recommended Previous Knowledge	Fundamentals of electrical engineering			
Knowledge	Basics of physics			
Educational Objectives	After taking part successfully, students have reached the fo	llowing learning results		
Professional Competence				
Knowledge	Students are able to explain the functionality of different controls.	erent MOS devices in electronic circuits.		
	Students know the fundamental digital logic circuits		dvantages.	
	Students have solid knowledge about memory circular			
	Students are able to explain how analog circuits fur			
	Students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the use of the students know the appropriate fields for the students know the students know the appropriate fields for the appropriate fields for the students know the appropriate fields for the students know the appropriate fields for the students know the students know the students know the students know the stud			
Skills				
Onno	 Students can calculate the specifications of differen 	t MOS devices and can define the parameter	rs of electronic circuits.	
	Students are able to develop different logic circuits	and can design different types of logic circuit	S.	
	 Students can use MOS devices, operational amplifi 	ers and bipolar transistors for specific applications	ations.	
Paramal Commetence				
Personal Competence Social Competence				
Social Competence	 Students are able work efficiently in heterogeneous 	teams.		
	 Students working together in small groups can solv 	e problems and answer professional question	ons.	
Autonomy	Students are able to access their level of knowledge	2		
	Students are able to assess their level of knowledge	z .		
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): Specialis	sation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialis	• •		
	General Engineering Science (German program, 7 semest			
	General Engineering Science (German program, 7 semest		Focus Mechatronics: Compu	sory
	Computer Science: Specialisation Computer and Software	Engineering: Elective Compulsory		
	Electrical Engineering: Core qualification: Compulsory	office Florida Forms of the Original		
	General Engineering Science (English program): Specialis		-t	
	General Engineering Science (English program, 7 separate			
	General Engineering Science (English program, 7 semeste	, ,		eon/
	General Engineering Science (English program, 7 semeste		-ocus iviecnaironics: Compul	sury
	Computational Science and Engineering: Specialisation C Mechanical Engineering: Specialisation Mechatronics: Cor			
	Mechatronics: Core qualification: Compulsory	привоту		
	Technomathematics: Core qualification: Elective Compulsor	orv		
	Technomathematics: Specialisation III. Engineering Science			
		S. E. Stave Comparisory		



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	Prof. Wolfgang Krautschneider
Language	DE
Cycle	SoSe
Content	Basic circuits with MOS transistors for logic gates and amplifiers Typical applications for analog and digital circuits Realization of logical functions Memory circuits Scaling-down of CMOS circuits and further performance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits Electrical behavoir of BiCMOS circuits 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://dx.doi.org/10.1007/978-3-642-20887-4 URL: http://dx.doi.org/10.1007/978-3-642-20887-4
	URL: http://www.ciando.com/img/bo

Course L0864: Semiconductor Circuit Design	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Wolfgang Krautschneider
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0854: Mathematic	es IV			
Courses				
Title		Тур	Hrs/wk	СР
Differential Equations 2 (Partial Differential	Equations) (L1043)	Lecture	2	1
Differential Equations 2 (Partial Differential		Recitation Section (small)	1	1
Differential Equations 2 (Partial Differential	Equations) (L1045)	Recitation Section (large)	1	1
Complex Functions (L1038)		Lecture	2	1
Complex Functions (L1041)		Recitation Section (small)	1	1
Complex Functions (L1042)	Doct Accords Town	Recitation Section (large)	1	1
Module Responsible Admission Requirements	Prof. Anusch Taraz			
Recommended Previous	Mathematics 1 - III			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the f	ollowing learning results		
Professional Competence				
Knowledge				
	Students can name the basic concepts in Mathematical concepts in M			Station to the of account of
	Students can discuss logical connections between They know proof strategies and can reproduce the		g inese connections w	ith the help of examples.
	They know proof strategies and can reproduce the	m.		
0.11				
Skills	Students can model problems in Mathematics IV v	vith the help of the concepts studied in this cour	se. Moreover, they are	capable of solving then
	by applying established methods.			
	Students are able to discover and verify further log	ical connections between the concepts studied	in the course.	
	For a given problem, the students can develop and	d execute a suitable approach, and are able to c	ritically evaluate the re	esults.
Personal Competence				
Social Competence				
	Students are able to work together in teams. They			
	In doing so, they can communicate new concepts		rtners. Moreover, they	can design examples to
	check and deepen the understanding of their peer	S.		
Autonomy	Students are capable of checking their understan	ding of complex concepts on their own. They o	an specify open ques	tions precisely and know
	where to get help in solving them.		. , , ,	, ,
	Students have developed sufficient persistence to	be able to work for longer periods in a goal-orie	nted manner on hard	oroblems.
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 min (Complex Functions) + 60 min (Differential Equation	ons 2)		
Assignment for the Following	General Engineering Science (German program): Special			
Curricula	General Engineering Science (German program): Special			
	General Engineering Science (German program): Special		ical Mechanical Engin	eering: Compulsory
	General Engineering Science (German program): Special			
	General Engineering Science (German program, 7 semes			maulaan
	General Engineering Science (German program, 7 semes	, ,		
	General Engineering Science (German program, 7 sen Compulsory	nester): Specialisation Mechanical Engineering	j, Focus Theoretical	wechanical Engineering
	General Engineering Science (German program, 7 semes	ster): Specialisation Naval Architecture: Computer	sorv	
	Computer Science: Specialisation Computational Mathem		501 y	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Speciali	sation Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialis			
	General Engineering Science (English program): Specialis		onics: Compulsorv	
	General Engineering Science (English program): Speciali			eering: Compulsory
	General Engineering Science (English program, 7 semes			•
	General Engineering Science (English program, 7 semes			npulsory
	General Engineering Science (English program, 7 sem	nester): Specialisation Mechanical Engineering	, Focus Theoretical	Mechanical Engineering
	Compulsory			
	General Engineering Science (English program, 7 semes	ter): Specialisation Naval Architecture: Compuls	ory	
	Computational Science and Engineering: Specialisation I	Engineering Sciences: Elective Compulsory		
	Computational Science and Engineering: Specialisation (Computer Science: Elective Compulsory		
	Mechanical Engineering: Specialisation Theoretical Mech	nanical Engineering: Compulsory		
	Mechanical Engineering: Specialisation Mechatronics: Co	ompulsory		
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Theoretical Mechanical Engineering: Technical Complem	entary Course Core Studies: Elective Compulso	rv	



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



ourses ttle troduction to Management (L0880) oject Entrepreneurship (L0882)				
troduction to Management (L0880)				
= : :		Тур	Hrs/wk	CP
oject Entrepreneursnip (L0882)		Lecture	3	3
Madula Baananaihla	Drof Christoph III	Problem-based Learning	2	3
Module Responsible	Prof. Christoph Ihl None			
Admission Requirements Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge	Basic Mowledge of Mathematics and Business			
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of Marketing and Innovation, and also to Investment and Controllin		nagement, from Planr	ning and Organisation
	explain the differences between Economics and Manage	ement and the sub-disciplines in Managem	ent and to name impo	rtant definitions from t
	field of Management	and the second s		
	 explain the most important aspects of and goals in Mana describe and explain basic business functions as prod 			
	ressource management, information management, innov		chain management, c	nganization and num
	explain the relevance of planning and decision making		Itiple objectives and	uncertainty, and expla
	some basic methods from mathematical Finance			
	state basics from accounting and costing and selected or	ontrolling methods.		
Skills	Students are able to analyse business units with respect	to different criteria (organization object	tives strategies etc) and to carry out
OKINS	Entrepreneurship project in a team. In particular, they are able to		aives, strategies etc.) and to carry out
	analyse Management goals and structure them appropri	•		
	analyse organisational and staff structures of companies			
	 apply methods for decision making under multiple objec analyse production and procurement systems and Busin 			
	analyse production and procurement systems and Busin analyse and apply basic methods of marketing	ess information systems		
	 select and apply basic methods from mathematical finan 	ce to predefined problems		
	apply basic methods from accounting, costing and control			
Personal Competence				
Social Competence	Students are able to			
	 work successfully in a team of students 			
	 to apply their knowledge from the lecture to an entrepren 	eurship 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. 			
	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			
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation			
· ·		, , ,	ompulsory	
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation	n Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation		mpulsory	
	General Engineering Science (German program): Specialisation	n Mechanical Engineering: Compulsory	mpulsory	
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	General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compupecialisation Process Engineering: Compupecialisation Biomedical Engineering: Compupecialisation Naval Architecture: Compulsor	ulsory Isory npulsory ory	
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	General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compu pecialisation Process Engineering: Compu pecialisation Biomedical Engineering: Com pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Bioprocess Engineering: Com pecialisation Civil Engineering: Compulsor	ulsory Isory pulsory ory opulsory y	
	General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compu pecialisation Process Engineering: Compu pecialisation Biomedical Engineering: Com pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Civil Engineering: Compulsor pecialisation Civil Engineering: Compulsor pecialisation Energy and Enviromental Eng	ulsory Isory npulsory ory npulsory y gineering: Compulsor	
	General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compu pecialisation Process Engineering: Compu pecialisation Biomedical Engineering: Com pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Civil Engineering: Compulsor pecialisation Energy and Enviromental Eng pecialisation Mechanical Engineering, Foc	ulsory Isory npulsory ory npulsory y gineering: Compulsor us Mechatronics: Cor	npulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compu pecialisation Process Engineering: Compu pecialisation Biomedical Engineering: Com pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Civil Engineering: Compulsor pecialisation Energy and Enviromental Eng pecialisation Mechanical Engineering, Foc pecialisation Mechanical Engineering, Foc pecialisation Mechanical Engineering, Foc	ulsory Isory npulsory ory npulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co	npulsory mpulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compu pecialisation Process Engineering: Compu pecialisation Biomedical Engineering: Com pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Civil Engineering: Compulsor pecialisation Energy and Enviromental Eng pecialisation Mechanical Engineering, Foc	ulsory Isory npulsory ory npulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E	npulsory mpulsory ngineering: Compulso
	General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compu pecialisation Process Engineering: Compu pecialisation Biomedical Engineering: Com pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Civil Engineering: Compulsor pecialisation Energy and Enviromental Eng pecialisation Mechanical Engineering, Foc	ulsory Isory npulsory ory npulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems E	npulsory mpulsory ngineering: Compulso



Compulsory

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

ompulsory

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

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

Energy and Environmental Engineering: Core qualification: Compulsory

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

 $\label{thm:condition} \textbf{General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory and the second seco$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

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

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

Technomathematics: Core qualification: Compulsory



Tun	Lecture
Typ	3
Hrs/wk	
	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga
Lammina	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona DE
Language	WiSe/SoSe
Cycle	WI26/2026
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
Enterdature	
	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
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,
	using their knowledge from the corresponding lecture.
	Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Focus Product Development and Production

The specialization Product Development and Production in the field of study Mechanical Engineering of the course of study General Engineering Science enables a consecutive study of the master Product Development and Production. The specialization maps the product creation process from systematic and methodical development of products, including concept development, design, utilisation of 3D-CAD and Product data management systems, material selection, simulation and test to production, the planning and control and the use of modern manufacturing processes, to high-performance materials.

Module M0597: Advanced	Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	СР
Advanced Mechanical Engineering Design	II (L0264)	Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
· · · · · · · · · · · · · · · · · · ·	FIGI. Dielei Klause			
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	learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
Kilowieuge	Aller passing the module, students are able to.			
	explain complex working principles and functions of machi	ine elements and of basic elements of flui	dics.	
	explain requirements, selection criteria, application scenar			
		aa praduda oxampies di complex me	2010 010/110/110,	
	 indicate the background of dimensioning calculations. 			
Skills	After passing the module, students are able to:			
	, passing are meaning, each and are are			
	 accomplish dimensioning calculations of covered machine 	e elements,		
	 transfer knowledge learned in the module to new requirem 	nents and tasks (problem solving skills).		
	recognize the content of technical drawings and schematic			
		o sketches,		
	 evaluate complex designs, technically. 			
Paraenal Competence				
Personal Competence				
Social Competence	Students are able to discuss technical information in the least	cture supported by activating methods		
	Olddenis are able to discuss technical information in the lef	cture 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 conte	nt e.g. by using the	video recordings of t
	lectures.			
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Specialisation N	Mechanical Engineering, Focus Energy Sy	stems: Compulsory	
Curricula	General Engineering Science (German program): Specialisation N	Mechanical Engineering, Focus Aircraft Sy	stems Engineering:	Compulsory
	General Engineering Science (German program): Specialisation M	Mechanical Engineering, Focus Materials	in Engineering Scier	nces: Compulsory
	General Engineering Science (German program): Specialisation N			
	General Engineering Science (German program): Specialisation M			duction: Compulsory
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	General Engineering Science (German program): Specialisation N			
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering	, Focus Materials in	n Engineering Science
	Compulsory			
	General Engineering Science (German program, 7 semester): Spe	ecialisation Mechanical Engineering. Foci	us Mechatronics: Coi	mpulsory
	General Engineering Science (German program, 7 semester): S			
		postanouson moonamoar Engineering, I	JUNE 1 TOURING DAVE	.op.non. and 1 loadoll
	Compulsory		_	
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering,	Focus Theoretical I	Mechanical Engineering
	Compulsory			
	General Engineering Science (German program, 7 semester): Spe	ecialisation Mechanical Engineering, Foci	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (English program): Specialisation M			
				O
	General Engineering Science (English program): Specialisation M	·		
	General Engineering Science (English program): Specialisation M	Mechanical Engineering, Focus Materials i	n Engineering Scien	ices: Compulsory
	General Engineering Science (English program): Specialisation M	Mechanical Engineering, Focus Mechatror	ics: Compulsory	
	deneral Engineering colonice (Engilon program), openialisation is			
		lechanical Engineering, Focus Product De		duction: Compulsory
	General Engineering Science (English program): Specialisation M			
	General Engineering Science (English program): Specialisation M General Engineering Science (English program): Specialisation M	Mechanical Engineering, Focus Theoretica	I Mechanical Engine	eering: Compulsory
	General Engineering Science (English program): Specialisation M	Mechanical Engineering, Focus Theoretica	I Mechanical Engine	eering: Compulsory
	General Engineering Science (English program): Specialisation M General Engineering Science (English program): Specialisation M	Mechanical Engineering, Focus Theoretical ecialisation Mechanical Engineering, Focus	l Mechanical Engine s Aircraft Systems Er	eering: Compulsory ngineering: Compulsor
	General Engineering Science (English program): Specialisation M General Engineering Science (English program): Specialisation M General Engineering Science (English program, 7 semester): Spe	Mechanical Engineering, Focus Theoretical ecialisation Mechanical Engineering, Focus	l Mechanical Engine s Aircraft Systems Er	eering: Compulsory ngineering: Compulsor
	General Engineering Science (English program): Specialisation M General Engineering Science (English program): Specialisation M General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester): Compulsory	Mechanical Engineering, Focus Theoretical cialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering	ll Mechanical Engine s Aircraft Systems En Focus Materials in	eering: Compulsory ngineering: Compulsor n Engineering Science
	General Engineering Science (English program): Specialisation M General Engineering Science (English program): Specialisation M General Engineering Science (English program, 7 semester): Spe General Engineering Science (English program, 7 semester):	Mechanical Engineering, Focus Theoretical cialisation Mechanical Engineering, Focus Specialisation Mechanical Engineering recialisation Mechanical Engineering, Focus	Il Mechanical Engine s Aircraft Systems En Focus Materials in s Mechatronics: Con	pering: Compulsory ngineering: Compulsor n Engineering Science npulsory



Compulsory

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

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

Naval Architecture: Core qualification: Compulsory

ourse L0264: Advanced Mechanic	al Engineering Design II
Тур	Lecture
Hrs/wk	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
	Sowie weitere auchter zu speziellen inemen

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
Content	Advanced wechanical Engineering Design Lati
	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 Carely accord
	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	



M. J. J. MOZOE B. J. J. J.	F			
Module M0725: Production	i Engineering			
Courses				
Title		Тур	Hrs/wk	СР
Production Engineering I (L0608)		Lecture	2	2
Production Engineering I (L0612)		Recitation Section (large)	1	1
Production Engineering II (L0610)		Lecture	2	2
Production Engineering II (L0611)		Recitation Section (large)	1	1
Module Responsible	Prof. Wolfgang Hintze			
Admission Requirements	none			
Recommended Previous	no course assessments required			
Knowledge				
	internship recommended			
Educational Objections	After telling and acceptable at all and a telling at a	la a un la contra de la contra del la contra de la contra del la contra de la contra de la contra de la contra de la contra del la contra de la contra de la contra de la contra del la contra del la contra del la contra de la contra del la		
Educational Objectives	After taking part successfully, students have reached the following I	learning results		
Professional Competence				
Knowledge	Students are able to			
	name basic criteria for the selection of manufacturing process.	202		
	name the main groups of Manufacturing Technology.			
		accac		
	name the application areas of different manufacturing proce name boundaries, advantages and disadvantages of the diff			
	name boundaries, advantages and disadvantages of the difference of the differen			
	describe elements, geometric properties and kinematic variations and the second s	ables and requirements for tools, workp	nece and process.	
	 explain the essential models of manufacturing technology. 			
Skills	Students are able to			
	• coloct manufacturing processes in accordance with the regu	iramenta		
	select manufacturing processes in accordance with the requ		to be seen decreased	
	design manufacturing processes for simple tasks to meet the		to be produced.	
	assess components in terms of their production-oriented con	nstruction.		
Personal Competence				
Social Competence	Students are able to			
	 develop solutions in a production environment with qualified 	b personner at technical level and repre	sent decisions.	
Autonomy	Students are able to			
	 interpret independently the manufacturing process. 			
	1			
	assess own strengths and weaknesses in general.	word		
	assess their learning progress and define gaps to be impro	veu.		
	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	120 min			
Assignment for the Following	General Engineering Science (German program, 7 semester): S	Specialisation Mechanical Engineering	, Focus Theoretical M	Mechanical Engineering
Curricula	Elective Compulsory	, and a second second	, , , , , , , , , , , , , , , , , , , ,	
23.110414	General Engineering Science (German program, 7 semester): Sp	pecialisation Mechanical Engineering	Focus Product Devel	opment and Production
	Compulsory			
	1	population Machanical Engineering	Focus Theoretical A	Acchanical Engineering
	General Engineering Science (English program, 7 semester): S	peciansalion wechanical Engineering	, rocus meoretical N	wechanical Engineering
	Floriting Community			
	Elective Compulsory			
	General Engineering Science (English program, 7 semester): Sp	pecialisation Mechanical Engineering,	Focus Product Devel	opment and Production
		pecialisation Mechanical Engineering,	Focus Product Devel	opment and Production
	General Engineering Science (English program, 7 semester): Sp		Focus Product Devel	opment and Production
	General Engineering Science (English program, 7 semester): Sp Compulsory		Focus Product Devel	opment and Production



Course L0608: Production Engineer	ing I
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Wolfgang Hintze
Language	DE
Cycle	WiSe
Content	Manufacturing Accuracy Manufacturing Metrology Measurement Errors and Uncertainties Introduction to Forming Massiv forming and Sheet Metal Forming Introduction to Machining Technology Geometrically defined machining (Turning, milling, drilling, broaching, planning)
Literature	Dubbel, Heinrich (Grote, Karl-Heinrich.; Feldhusen, Jörg.; Dietz, Peter.; Ziegmann, Gerhard.;) Taschenbuch für den Maschinenbau : mit Tabellen. Berlin [u.a.] : Springer, 2007 Fritz, Alfred Herbert: Fertigungstechnik : mit 62 Tabellen. Berlin [u.a.] : Springer, 2004 Keferstein, Claus P (Dutschke, Wolfgang.;): Fertigungsmesstechnik : praxisorientierte Grundlagen, moderne Messverfahren. Wiesbaden : Teubner, 2008 Mohr, Richard: Statistik für Ingenieure und Naturwissenschaftler : Grundlagen und Anwendung statistischer Verfahren. Renningen : expert-Verl, 2008 Klocke, F., König, W.: Fertigungsverfahren Bd. 1 Drehen, Fäsen, Bohren. 8. Aufl., Springer (2008) Klocke, Fritz (König, Wilfried.;): Umformen. Berlin [u.a.] : Springer, 2006 Paucksch, E.: Zerspantechnik, Vieweg-Verlag, 1996 Tönshoff, H.K.; Denkena, B., Spanen. Grundlagen, Springer-Verlag (2004)

Course L0612: Production Engineering I	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Wolfgang Hintze
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0610: Production Engineer	ing II
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Wolfgang Hintze, Prof. Claus Emmelmann
Language	DE
Cycle	SoSe
Content	Geometrically undefined machining (grinding, lapping, honing) Introduction into erosion technology Introduction into blastig processes Introduction to the manufacturing process forming (Casting, Powder Metallurgy, Composites) Fundamentals of Laser Technology Process versions and Fundamentals of Laser Joining Technology
Literature	Klocke, F., König, W.: Fertigungsverfahren Bd. 2 Schleifen, Honen, Läppen, 4. Aufl., Springer (2005) Klocke, F., König, W.: Fertigungsverfahren Bd. 3 Abtragen, Generieren und Lasermaterialbearbeitung. 4. Aufl., Springer (2007) Spur, Günter (Stöferle, Theodor.;): Urformen. München [u.a.]: Hanser, 1981 Schatt, Werner (Wieters, Klaus-Peter,; Kieback, Bernd,;): Pulvermetallurgie: Technologien und Werkstoffe. Berlin [u.a.]: Springer, 2007



Course L0611: Production Engineering II	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Wolfgang Hintze, Prof. Claus Emmelmann
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0596: Advanced I	Mechanical Design Project
Courses	
Title	Typ Hrs/wk CP
Advanced Mechanical Design Project (L02	
Module Responsible	Prof. Dieter Krause
Admission Requirements	None
Recommended Previous	
Knowledge	Mechanical Engineering: Design
	Advanced Mechanical Engineering Design
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	After passing the module, students are able to:
	express the procedure for systematically handling of
	complex design tasks ,
	describe working principles, their use and combination possibilities,
	explain guidelines for designing for function and manufacturing,
	explain advanced use-oriented knowledge of machine elements.
OL III.	After a section the great the state of the transfer to
SKIIIS	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
	• Tellect the own results in the work groups of the course
Autonomy	After passing the module, students are able to:
	independently solve complex design projects, while motivating themselves, acquiring necessary knowledge and selecting appropriate 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 Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Curricula	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsor
	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 (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production
	Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering
	Compulsory
	Mechanical Engineering: Core qualification: Compulsory



Course L0266: Advanced Mechanical Design Project		
Тур	Practical Course	
Hrs/wk	4	
СР	6	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff, Dr. Jens Schmidt, Dr. Volkert Wollesen	
Language	DE	
Cycle	WiSe	
Content	Das Konstruktionsprojekt gliedert sich in den Entwurf eines Getriebes sowie die Lösungsfindung.	
	Getriebekonstruktion in Einzelarbeit	
	Erarbeitung von Lösungsprinzipien	
	Berechnung von Maschinenelementen	
	 Entwurf eines Getriebes im Hauptschnitt plus allen Außenansichten 	
	 Erstellung einer ausführlichen Dokumentation 	
	Lösungsfindung	
	 Methodische Erarbeitung von prinzipiellen Lösungskonzepten 	
	Erstellen einer Dokumentation	
Literature	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.	
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.	
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. 	
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.	
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.	
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.	
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.	
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.	
	Sowie weitere Bücher zu speziellen Themen	



Module M0726: Production	Technology			
Courses				
Title		Typ	Hrs/wk	CP
Fundamentals of Machine Tools (L0689)		Typ	3	3
Forming and Cutting Technology (L0613)		Lecture Lecture	2	2
Forming and Cutting Technology (L0614)		Recitation Section (large)	1	1
Module Responsible	Prof. Wolfgang Hintze	rectitation occiton (large)	· · · · · · · · · · · · · · · · · · ·	
Admission Requirements	None			
Recommended Previous	without major course assessment			
Knowledge	without major course assessment			
····ougo	internship recommended			
	Previous knowledge in mathematics, mechanics and electrical	engineering		
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	Students are able to			
	 explain the basics of chip formation and mechanisms a 	nd models of machining.		
	 explain methods and parameters for design and analys 	is of metal forming, machining processes	and tools.	
	 explain technical concepts of machine tool building and 	d give an overview on trends in the machi	ne tool industry.	
	 explain types, constructions and functions of CNC-mac 	hines and give an overview on multi-mach	nine systems.	
	 explain equipment components. 			
Skills	Students are able to			
			- :	
	select tool geometry, cutting materials, process parame		e in accordance with the	requirements.
	estimate occurring forces and temperatures during chip formation.			
	 select appropriate machine tools for machining and cre 	ate NC programs for turning and milling.		
	assess the quality of a machine tools and to detect weak points.			
Personal Competence				
Social Competence	Students are able to			
	develop solutions in a production environment with qua	ilified personnel at technical level and rep	present decisions.	
Autonomy	Students are able to			
	 interpret independently cutting processes. 			
	 create independently NC programs. 			
		rapriato raquiramente		
	select independently machine tools by reference to app	ropriate requirements.		
	assess own strengths and weaknesses in general.			
	assess their learning progress and define gaps to be in	nproved.		
	 assess possible consequences of their actions. 			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation		•	
Curricula	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	g, Focus Product Development	opment and Producti
	Compulsory			
	General Engineering Science (English program): Specialisatio	n Mechanical Engineering, Focus Produc	t Development and Prod	uction: Compulsory
	General Engineering Science (English program, 7 semester		·	
	Compulsory		J	,
	Mechanical Engineering: Specialisation Product Development	and Production: Compulsory		
	Product Development, Materials and Production: Technical Co		ive Compulsory	
	Froduct Development, ivialerials and Production: Technical Co	implementary Course Core Studies: Electi	ive Compuisory	



Course L0689: Fundamentals of Mac	chine Tools
Typ	Lecture
	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Thorsten Schüppstuhl
Language	DE
Cycle	WiSe
Content	Terminology and trends in machine tool building
	CNC controls
	NC programming and NC programming systems
	Types, construction and function of CNC machines
	Multi-machinesystems
	Equipmentcomponents for machine tools
	Assessment of machine tools
Literature	Conrad, K.J
	Taschenbuch der Werkzeugmaschinen
	9783446406414
	Fachbuchverlag 2006
	Perović, Božina
	Spanende Werkzeugmaschinen - Ausführungsformen und Vergleichstabellen
	ISBN: 3540899529
	Berlin [u.a.]: Springer, 2009
	Weck, Manfred
	Werkzeugmaschinen 1 - Maschinenarten und Anwendungsbereiche
	ISBN: 9783540225041
	Berlin [u.a.]: Springer, 2005
	Weck, Manfred; Brecher, Christian
	Werkzeugmaschinen 4 - Automatisierung von Maschinen und Anlagen
	ISBN: 3540225072
	Berlin [u.a.]: Springer, 2006
	Weck, Manfred; Brecher, Christian
	Werkzeugmaschinen 5 - Messtechnische Untersuchung und Beurteilung, dynamische Stabilität
	ISBN: 3540225056
	Berlin [u.a.]: Springer, 2006



Course L0613: Forming and Cutting Technology		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Wolfgang Hintze	
Language	DE	
Cycle	WiSe	
Content	Thermomechanical Principles and Models of Machining Chip Formation, Forces, Temperature and Tribology process Wear mechanisms and wear patterns Machinability by Cutting and Forming, Specific Problems of Light Weight Structures Cutting Material and Coatings Methods and Parameters for Analysis and Configuration of Forming and Cutting Processes and Tools	
Literature	Lange, K.; Umformtechnik Grundlagen, 2. Auflage, Springer (2002) Tönshoff, H.; Spanen Grundlagen, 2. Auflage, Springer Verlag (2004) König, W., Klocke, F.; Fertigungsverfahren Bd. 4 Massivumformung, 4. Auflage, VDI-Verlag (1996) König, W., Klocke, F.; Fertigungsverfahren Bd. 5 Blechbearbeitung, 3. Auflage, VDI-Verlag (1995) Klocke, F., König, W.; Fertigungsverfahren Schleifen, Honen, Läppen, 4. Auflage, Springer Verlag (2005) König, W., Klocke, F.: Fertigungsverfahren Drehen, Fräsen, Bohren, 7. Auflage, Springer Verlag (2002)	

Course L0614: Forming and Cutting Technology		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Wolfgang Hintze	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



	Engineering			
Courses				
Title	Тур		Hrs/wk	СР
Computer Engineering (L0321)	Lect	ure	3	4
Computer Engineering (L0324)		itation Section (small)	1	2
Module Responsible	Prof. Heiko Falk			
Admission Requirements	None			
Recommended Previous Knowledge	Basic knowledge in electrical engineering			
Knowledge	The successful completion of the labs will be honored during the evaluation of the	e module's examination ac	ccording to the followi	ng rules:
	Upon a passed module examination, the student is granted a bonus examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-b		rks due to the succes	ssful labs, such that t
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not pos			
Educational Objectives	After taking part successfully, students have reached the following learning resul	IS		
Professional Competence Knowledge	This module deals with the foundations of the functionality of computing syste gates. The module includes the following topics:	ms. It covers the layers fro	om the assembly-leve	el programming down
	Introduction Combinational logic: Gates, Boolean algebra, Boolean functions, hardwa Sequential logic: Flip-flops, automata, systematic hardware design Technological foundations	are synthesis, combinationa	al networks	
	Computer arithmetic: Integer addition, subtraction, multiplication and division.	sion		
	Basics of computer architecture: Programming models, MIPS single-cycle	architecture, pipelining		
	Memories: Memory hierarchies, SRAM, DRAM, caches			
	 Input/output: I/O from the perspective of the CPU, principles of passing da 	ta, point-to-point connection	ons, busses	
Skills	The students perceive computer systems from the architect's perspective, i.e computer systems. The students can analyze, how highly specific and individual computer systems.	dual computers can be bu	uilt based on a colle	ction of few and simp
	components. They are able to distinguish between and to explain the different a up to complete processors.	abstraction layers of today'	's computing systems	- from gates and circu
	After successful completion of the module, the students are able to judge the in			
	executed on it. In particular, they shall understand the consequences that the e			
	the assembly language down to gates. This way, they will be enabled to evaluate	e the impact that these low	abstraction levels ha	ave on an entire syster
	performance and to propose feasible options.			
Personal Competence				
Social Competence	Students are able to solve similar problems alone or in a group and to present th	e results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific literature and to associate	ciate this knowledge with o	ther classes	
		Jaco and talemough war o		
	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes, contents of course and labs			
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsor			
Curricula	General Engineering Science (German program, 7 semester): Specialisation Co General Engineering Science (German program, 7 semester): Specialisation Bio		-	
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	General Engineering Science (German program, 7 semester): Specialisation Ele	0 0 1	ry ulsory	
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Technomathematics: Specialisation II. Informatics: Elective Compulsory



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

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

Tun	Recitation Section (small)
Hrs/wk	
СР	
	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	1. Introduction
	Displication of distinct design
	Principles of digital design Applications of Right.
	Analog versus Digital Output and fire flows
	Gates and flip-flops Appet to fill-fill decision
	Aspects of digital design Aspects of digital design
	Integrated cicuits Digital devices
	Digital devices Time to product
	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 shifte
- 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
- 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



OUTEGE			
ourses	Tue Ur	rs/wk	CP
troduction to Control Systems (L0654)	Typ Hr Lecture 2	S/WK	4
troduction to Control Systems (L0655)	Recitation Section (small) 2		2
Module Responsible	Prof. Herbert Werner		
Admission Requirements	none		
Recommended Previous	Representation of signals and systems in time and frequency domain, Laplace transform		
Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge			
	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain	properties of	f first and second ord
	systems They can explain the dynamics of simple control loops and interpret dynamic proporties in terms of frequency.	rosponso and	d root loous
	 They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency references. They can explain the Nyquist stability criterion and the stability margins derived from it. 	response and	a root locus
	They can explain the royquist stability chiefion and the stability margins derived from it. They can explain the role of the phase margin in analysis and synthesis of control loops		
	They can explain the role of the phase margin in analysis and synthesis of control loops They can explain the way a PID controller affects a control loop in terms of its frequency response		
	They can explain issues arising when controllers designed in continuous time domain are implemented digital	llv	
		,	
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 tech	nniques	
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digitate.		ation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks	,	
Personal Competence			
Social Competence		-	
Autonomy		es) and use	it when solving giv
	problems.		
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.		
Workload in Hours			
Credit points	6		
Credit points Examination	6 Written exam		
Credit points	6 Written exam		
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory		
Credit points Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory		
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatic General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus M Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus M Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering: Core qualification: Compulsory Computer Science: Specialisation Computational Mathematics: Elective Compulsory	tronics: Comp chanics: Com Systems Eng Materials in I neoretical Me duct Develop	pulsory pineering: Compulsor Engineering Science schanical Engineering ment and Producti
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatic General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mochanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mochanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mochanical Engineering, Focus	tronics: Comp chanics: Com Systems Eng Materials in I neoretical Me duct Develop	pulsory pineering: Compulsor Engineering Science schanical Engineering ment and Producti
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechati General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus N Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus N Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus N Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Proc Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering: Core qualification: Compulsory Energy and Environme	tronics: Comp chanics: Com Systems Eng Materials in I neoretical Me duct Develop	pulsory pineering: Compulsor Engineering Science schanical Engineering ment and Producti
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatic General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatic General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering,	tronics: Comp chanics: Com Systems Eng Materials in I neoretical Me duct Develop	pulsory pineering: Compulsor Engineering Science schanical Engineering ment and Producti
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: General Engineering Science (German program, 7 semester): Specialisation Process Engineering. Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus McOmpulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus McOmpulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus McOmpulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering: Core qualification: Compulsory Engla Engineering Science (Eng	tronics: Comp chanics: Com Systems Eng Materials in I neoretical Me duct Develop	pulsory pineering: Compulsor Engineering Science schanical Engineering ment and Producti
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatican Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus McCompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus McCompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus McCompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theorems Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisat	tronics: Comp chanics: Com Systems Eng Materials in I neoretical Me duct Develop	pulsory pineering: Compulsor Engineering Science schanical Engineerin pment and Producti
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatican Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomec General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus McCompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus McCompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus McCompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theorems Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Bioprocess Engineering Science (German program, 7 semester): Specialisat	tronics: Comp chanics: Com Systems Eng Materials in I neoretical Me duct Develop	pulsory gineering: Compulso Engineering Science schanical Engineerin ment and Production



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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

Process Engineering: Core qualification: Compulsory

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



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



Module M0599: Integrated I	Product Development and Lightweight De	sign				
Courses						
Title		Тур	Hrs/wk	CP		
CAE-Team Project (L0271)		Problem-based Learning	2	2		
Development of Lightweight Design Produ	cts (L0270)	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	following learning results				
Professional Competence						
Knowledge	After completing the module, students are capable of:					
	 explaining the functional principle of 3D-CAD-Sys 	tems, PDM- and FEM-Systems				
	 describing the interaction of the different CAE-Sys 	tems in the product development process				
Skills						
	After completing the module, students are able to:					
	The state of the s					
	 evaluate different CAD- and PDM-Systems with regards to the desired requirements such as classification schemes and product structuring design an exemplary product using CAD-,PDM- and/or FEM-Systems with shared workload 					
	design an exemplary product using OAD-, I DMF a	na/or r Elw-oystems with shared workload				
Davis and Commissions						
Personal Competence	After an annual attention that are advised and an annual block as					
Social Competence	After completing the module, students are able to:					
	To develop a project plan and allocate work appropriate work packages in the framework of group discussions					
	Present project results as a team for instance in a	presentation				
Autonomy	Students are capable of:					
,	•					
	 independently adapt to a CAE-Tool and complete 	a given practical task with it				
Workload in Hours	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): Specia	lisation Mechanical Engineering, Focus Aircraft	Systems Engineering:	Compulsory		
Curricula	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory					
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production					
		nester): Specialisation Mechanical Engineering	, Focus Product Deve	lopment and Producti		
	Compulsory General Engineering Science (English program): Special	igation Machanias Engineering France Aircraft	Systems Engineering	Compulsory		
	General Engineering Science (English program): Special General Engineering Science (English program): Special					
	General Engineering Science (English program): Special General Engineering Science (English program, 7 semes	0 0,	·	, ,		
	General Engineering Science (English program, 7 semes		•			
	Compulsory		,	and i roddol		
	Mechanical Engineering: Specialisation Product Develop	ment and Production: Compulsory				
	Mechanical Engineering: Specialisation Aircraft Systems	Engineering: Compulsory				
	Product Development, Materials and Production: Technic	al Complementary Course Core Studies: Electiv	ve Compulsory			



Course L0271: CAE-Team Project	
Тур	Problem-based Learning
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause
Language	DE
Cycle	SoSe
Content	 Practical Introduction in the used software systems (Creo, Windchill, Hyperworks) Team formation, allocation of tasks and generation of a project plan Collective creation of one product out of CAD models supported by FEM calculations and PDM system Manufacturing of selected parts using 3D printer Presentation of results Description Part of the module is a project based team orientated practical course using the PBL method. In this course, students learn the handling of modern CAD, PDM and FEM systems (Creo, Windchill and Hyperworks). After a short introduction in the applied software systems, students work in teams on a task during the semester. The aim is the development of one product out of several CAD parts models using a PDM system including FEM calculations of selected parts and 3D printing of parts. The developed product must be presented in a joint presentation.
Literature	•

Course L0270: Development of Ligh	ntweight Design Products
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause
Language	DE
Cycle	SoSe
Content	Lightweight design materials Product development process for lightweight structures Dimensioning of lightweight structures
Literature	 Schürmann, H., "Konstruieren mit Faser-Kunststoff-Verbunden", Springer, Berlin, 2005. Klein, B., "Leichtbau-Konstruktion", Vieweg & Sohn, Braunschweig, 1989. Krause, D., "Leichtbau", In: Handbuch Konstruktion, Hrsg.: Rieg, F., Steinhilper, R., München, Carl Hanser Verlag, 2012. Schulte, K., Fiedler, B., "Structure and Properties of Composite Materials", Hamburg, TUHH - TuTech Innovation GmbH, 2005. Wiedemann, J., "Leichtbau Band 1: Elemente", Springer, Berlin, Heidelberg, 1986.

Course L0269: Integrated Product D	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 M1005: Enhanced I	Fundamentals of Materials Science				
-					
Courses					
Title		Тур		Hrs/wk	CP
Fundamentals of Metallic Materials (L1086		Lecture		2	3
Fundamentals of Ceramic and Polymer Materials (L1233) Lecture 2			2		
Fundamentals of Ceramic and Polymer Ma		Recitation S	Section (large)	1	1
	Prof. Gerold Schneider				
Admission Requirements	None				
Recommended Previous	Module "Fundamentals of Materials Science"				
Knowledge	Module "Materials Science Laboratory"				
	,				
	Module "Advanced Materials"				
Educational Objectives	After taking part successfully, students have reached	the following learning regults			
· · · · · · · · · · · · · · · · · · ·	The landing part successions, students have reached	and ronowing rearring results			
Professional Competence	The state of the s	and the College Control of the			
Knowledge	The students are able to give an enhanced overview	- '	defeate allegables beauties		dense to out on a seal of the con-
	in metals, polymers and ceramics: Atomic bonds, co		defects, electrical and m	ass transport, m	nicrostructure and phase
	diagrams. They are capable to explain the correspon	ding technical terms.			
Skills	The students are able to apply the appropriate physic	cal and chemical methods for the	above mentioned subjects	S.	
Personal Competence					
Social Competence					
,	The students are excepted to redenstand independent		f annuaries mastels and a	alumanua. Thaire	بالمقادم مقامات مطالحان مما
Autonomy	The students are capable to understand independe	mily the structure and properles of	i ceramics, metals and p	olymers. They s	should be able to critally
	evaluate the profoundness of their knowledge.				
Workload in Hours	Independent Study Time 110, Study Time in Lecture	70			
Credit points	6				
Examination	Written exam				
Examination duration and scale					
Assignment for the Following	General Engineering Science (German program): Sp	ecialisation Mechanical Engineer	ing, Focus Materials in En	gineering Scien	ces: Compulsory
Curricula	General Engineering Science (German program,	7 semester): Specialisation Mecl	nanical Engineering, Foo	us Materials in	Engineering Sciences:
	Compulsory				
	General Engineering Science (German program, 7	semester): Specialisation Mecha	nical Engineering, Focus	Product Devel	opment and Production:
	Compulsory				
	General Engineering Science (English program): Sp	ecialisation Mechanical Engineeri	ng, Focus Materials in Eng	gineering Scien	ces: Compulsory
	General Engineering Science (English program, 7	semester): Specialisation Mech	nanical Engineering, Foc	us Materials in	Engineering Sciences:
	Compulsory				
	General Engineering Science (English program, 7	semester): Specialisation Mecha	nical Engineering, Focus	Product Devel	opment and Production:
	Compulsory				
	Mechanical Engineering: Specialisation Materials in	Engineering Sciences: Compulso	ry		
	Technomathematics: Specialisation III. Engineering S	Science: Elective Compulsory			
	Technomathematics: Core qualification: Elective Cor	npulsory			
	recimonatilenatics. Core qualification: Elective Cor	ipuis01y			

Course L1086: Fundamentals of Me	Course L1086: Fundamentals of Metallic Materials	
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		
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	



Ones I 1000 Francis	namic and Dahman Materials
Course L1233: Fundamentals of Ce	
	Lecture 2
Hrs/wk	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Gerold Schneider, Prof. Bodo Fiedler
Language	DE/EN
Cycle	
	1. Einführung
	Natürliche "Keramiken" – Steine "Künstliche" Keramik – vom Porzellan bis zur Hochleistungskeramik Anwendungen von Hochleistungskeramik
	"Runsinche Refamik – vom Fützenan dis zur nochleisigingskeranik Anwendungen von nochleistungskeranik
	2. Pulverherstellung
	Einteilung der Pulversyntheseverfahren
	Der Bayer-Prozess zur Al2O3-Herstellung
	Der Acheson-Prozess zur SiC-Herstellung
	Chemical Vapour Deposition
	Pulveraufbereitung
	Mahltechnik
	Sprühtrockner
	3. Formgebung
	Arten der Formgebung
	Pressen (0 - 15 % Feuchte)
	Gießen (> 25 % Feuchte)
	Plastische Formgebung (15 - 25 % Feuchte)
	4. Sintern
	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
	Farraglaktisaha Karamikan
	Ferroelektische Keramiken
	Piezo-, ferroelektrische Materialeigenschaften
	Anwendungen
	Keramische Ionenleiter
	lanischa Laitähiakait
	Ionische Leitfähigkeit Dotiertes Zirkonoxid in der Brennstoffzelle und Lambdasonde
Literature	D R H Jones, Michael F. Ashby, Engineering Materials 1, An Introduction to Properties, Applications and Design, Elesevier
	D.W. Richerson, Modern Ceramic Engineering, Marcel Decker, New York, 1992
	W.D. Kingany Introduction to Coronics, John Wilay & Sons, New York, 1975
	W.D. Kingery, Introduction to Ceramics, John Wiley & Sons, New York, 1975
	D.J. Green, An introduction to the mechanical properties of ceramics", Cambridge University Press, 1998
	D. Munz, T. Fett, Ceramics, Springer, 2001
	Polymerwerkstoffe
	Struktur und mechanische Eigenschaften G.W.Ehrenstein;
	Hanser Verlag; ISBN 3-446-12478-0; ca. 20 €
	Kunststoffphysik
	W.Retting, H.M.Laun; Hanser Verlag; ISBN 3446162356; ca. 25 €
	Worketoffkunda Kunstetoffa
	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: Fundamentals of Ceramic and Polymer Materials	
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



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



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 Environmental Engeneering: Compulsory

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

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

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

deficial Engineering Science (English program). Specialisation Energy and Environmental Engineering. Compulsory

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

 $\label{thm:condition} \textbf{General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory and the state of the stat$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

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

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

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



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

Course L0882: Project Entrepreneu	ırship
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
Language	DE
Cycle	WiSe/SoSe
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept,
	using their knowledge from the corresponding lecture.
	Project work is carried out in teams with the support of a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.



Focus Theoretical Mechanical Engineering

The graduates acquire basic research and methodological oriented content mechanical engineering knowledge and associated mechanical engineering expertise to develop mathematical descriptions, analysis and synthesis of basic technical systems methods, products or processes. This course, concentrates on simulation technology, advanced mathematics and heat transfer, such that a continuous study in the Master program in Theoretical Mechanical Engineering is possible.

	Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	CP
Advanced Mechanical Engineering Design	n II (L0264)	Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Advanced Mechanical Engineering Design	ı I (L0262)	Lecture	2	2
Advanced Mechanical Engineering Design	ı I (L0263)	Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	a Fundamentals of Machanical Funiassian Da	-:		
Knowledge	Fundamentals of Mechanical Engineering De	sign		
	Mechanics Total acceptable (Materials Originals)			
	Fundamentals of Materials Science Production Engineering			
	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:			
		ions of machine elements and of basic elements of flu		
		cation scenarios and practical examples of complex n	nachine elements,	
	indicate the background of dimensioning calc	uiauoris.		
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of cover			
	_	new requirements and tasks (problem solving skills),		
	recognize the content of technical drawings at	nd schematic sketches,		
	evaluate complex designs, technically.			
Personal Competence				
Social Competence				
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Students are able to discuss technical information	ation in the lecture supported by activating methods.		
Autonomy				
Autonomy	Students are able to independently deepen th	eir acquired knowledge in exercises.		
	Students are able to acquire additional kno	wledge and to recapitulate poorly understood cont	ent e.g. by using the	video recordings of
	lectures.			
Workload in Hours	Independent Study Time 68, Study Time in Lecture 1	12		
Credit points	6	<u>-</u>		
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Sp	ecialisation Mechanical Engineering, Focus Energy S	Systems: Compulsory	
Curricula	General Engineering Science (German program): Sp			Compulsory
Carriodia		ecialisation Mechanical Engineering, Focus Materials		
	General Engineering Science (German program): Sp			,
	General Engineering Science (German program): Sp			duction: Compulsory
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	General Engineering Science (German program, 7			
	Compulsory	3	3,	3 3
	General Engineering Science (German program, 7 se	emester): Specialisation Mechanical Engineering, For	cus Mechatronics: Coi	mpulsorv
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	General Engineering Science (German program, 7 Compulsory	comocion). Operational medianical Engineering,		lopment and Producti
	General Engineering Science (German program, 7 Compulsory General Engineering Science (German program, 7		, Focus Theoretical I	
	Compulsory		, Focus Theoretical I	
	Compulsory General Engineering Science (German program, 7 Compulsory	semester): Specialisation Mechanical Engineering		Mechanical Engineeri
	Compulsory General Engineering Science (German program, 7	semester): Specialisation Mechanical Engineering	cus Biomechanics: Co	Mechanical Engineeri
	Compulsory General Engineering Science (German program, 7 Compulsory General Engineering Science (German program, 7 se	semester): Specialisation Mechanical Engineering emester): Specialisation Mechanical Engineering, For emester): Specialisation Mechanical Engineering, For	cus Biomechanics: Co cus Energy Systems: 0	Mechanical Engineeri
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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
	Epicyolic 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
	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	Advanced Mechanical Engineering Design I & II
Content	Advanced Mechanical Engineering Design Facility
	Lecture
	Fundamentals of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Seals
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank drives
	Sliding bearings
	Elements of fluidics
	Exercise
	Calculation methods of the following machine elements:
	 Linear rolling bearings
	Axes & shafts
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank gears
	Sliding bearings Calculations of hydrostatic systems (fluidics)
	- Calculations of Hydrostatic systems (indices)
Literature	Dubbel Teerberkush für der Merchinerheur Orde IV II. Feldburge 1/11-00 Order IV II. Feldburge 1/11-00 Order IV II.
	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Maschine and words. Read LIM Niconae 20. On income North and the N. A. (Income North and North Annual Communication).
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Bücher zu speziellen Themen
	The state of the s

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



ourses		
	Trus Hashida (OD.
tle	~	CP 4
gnals and Systems (L0432) gnals and Systems (L0433)		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 Mathemati	ik 1-3 is expe
	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 the	ory. They are
	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse de	eterministic siç
	and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image of	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 sy	ystem theory.
	can analyse and design basic systems regarding important properties such as magnitude and phase response, stability, linearity etc.	They can as
	the impact of LTI systems on the signal properties in time and frequency domain.	
Personal Competence		
Social Competence	The students can jointly solve specific problems.	
Autonomy	The students are able to acquire relevant information from appropriate literature sources. They can control their level of knowledge	during the le
Autonomy	period by solving tutorial problems, software tools, clicker system.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Credit points		
Examination	Written exam	
Examination duration and scale	90 min	
Assignment for the Following	General Engineering Science (German program): Specialisation 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: Compulso	ory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compu	ulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Enginee	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engin	
	Compulsory	Ü
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulso	orv
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechan	
	Compulsory	<u></u> giii66
	Computer Science: Core qualification: Compulsory	
	Electrical Engineering: Core qualification: Compulsory	
	General Engineering. Cone qualification. Compulsory General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory	
	General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory	
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory	
	General Engineering Science (English program): Specialisation Computer Science: Compulsory	
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory	
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulso	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Comput	•
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineer	ring: Compuls
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engin	neering Scie
	Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsor	ry
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechan	nical Enginee
	O markets	
	Compulsory	
	Compulsory Computational Science and Engineering: Core qualification: Compulsory	



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

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



courses		
ïtle	Typ Hrs/wk CP	
dvanced Mechanical Design Project (L0)	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 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.	
Chille	After a section the second of a students are able to	
SKIIIS	After passing the module, students are able to:	
	analyze complex tasks and develop principle solutions using sketches,	
	convert principle solutions into a detailed design,	
	use methods to design and solve engineering design tasks systematically and solution-oriented,	
	 create a technical documentation including all necessary technical drawings to understand the functions of the system, 	
	document calculations of selected machine elements clearly and in detail.	
Personal Competence		
	After passing the module, students are able to:	
Coolai Compositio	This passing the medicing discount are able to	
	 present and discuss solutions and technical drawings within groups, 	
	reflect the own results in the work groups of the course	
Autonomy	After passing the module, students are able to:	
,		
	 independently solve complex design projects, while motivating themselves, acquiring necessary knowledge and selecting appropriate met 	thod
	to independently solve problems.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56	
Credit points	6	
Examination	Written exam	
Examination duration and scale	180	
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulso	ory
	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsor	ry
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Comp	oulso
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Prod	ducti
	Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering	eeri
	Compulsory	
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory	
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulso	-
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsor	•
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compu	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Product Development De	Jucti
	Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering	eer
	Compulsory	
	Mechanical Engineering: Core qualification: Compulsory	



Course L0266: Advanced Mechanic	al Design Project
Тур	Practical Course
Hrs/wk	4
СР	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff, Dr. Jens Schmidt, Dr. Volkert Wollesen
Language	DE
Cycle	WiSe
Content	Das Konstruktionsprojekt gliedert sich in den Entwurf eines Getriebes sowie die Lösungsfindung.
	Getriebekonstruktion in Einzelarbeit
	Erarbeitung von Lösungsprinzipien
	Berechnung von Maschinenelementen
	 Entwurf eines Getriebes im Hauptschnitt plus allen Außenansichten
	 Erstellung einer ausführlichen Dokumentation
	Lösungsfindung
	 Methodische Erarbeitung von prinzipiellen Lösungskonzepten
	Erstellen einer Dokumentation
Literature	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Bücher zu speziellen Themen



Module M0684: Heat Transf	fer en			
Courses				
		Tun	Hro hule	CP
Title		Тур	Hrs/wk 3	
Heat Transfer (L0458) Heat Transfer (L0459)		Lecture Recitation Section (large)	2	5 1
Module Responsible	Dr. Andreas Moschallski	riecitation dection (large)		
Admission Requirements	none			
Recommended Previous	Technical Thermodynamics I, II and Fluid Dynamics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence	3,	3		
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 ap	oroach.		
Autonomy	The students are able to develop a complex problem self-consisten:	and analyse the results in a critical wa	ον Λ qualified evokan	no with other students is
Autonomy	given.	and analyse the results in a childar we	ty. A qualified excitati	ge with other students is
	g., e.,			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Biomecha	anics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Energy S	ystems: Compulsory	
	General Engineering Science (German program): Specialisation Bio	medical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Theoretic	al Mechanical Engine	ering: Compulsory
	General Engineering Science (German program, 7 semester): Speci	alisation Mechanical Engineering, Foc	us Energy Systems: C	ompulsory
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering,	Focus Theoretical M	lechanical Engineering:
	Compulsory			
	General Engineering Science (German program, 7 semester): Speci	alisation Biomedical Engineering: Con	npulsory	
	General Engineering Science (English program): Specialisation Bio			
	General Engineering Science (English program): Specialisation Med			
	General Engineering Science (English program): Specialisation Med			
	General Engineering Science (English program): Specialisation Med			
	General Engineering Science (English program, 7 semester): Specia			
	General Engineering Science (English program, 7 semester): Sp Compulsory	ecialisation Mechanical Engineering,	Focus Theoretical M	lechanical Engineering:
	General Engineering Science (English program, 7 semester): Specia	alisation Biomedical Engineering: Com	nulsorv	
	Mechanical Engineering: Specialisation Energy Systems: Compulso		, ,	
	Mechanical Engineering: Specialisation Theoretical Mechanical Engineering:			
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Course L0458: Heat Transfer	
Тур	Lecture
Hrs/wk	3
CP	5
Workload in Hours	Independent Study Time 108, 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	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dr. Andreas Moschallski
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses		
itle (1999)	Typ Hrs/wk	CP
Computer Engineering (L0321) Computer Engineering (L0324)	Lecture 3 Recitation Section (small) 1	2
Module Responsible		
Admission Requirements		
Recommended Previous		
Knowledge		
	The successful completion of the labs will be honored during the evaluation of the module's examination according to the following ru	ıles:
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the successful	labs, such that t
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.	
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge		ogramming down
	gates. The module includes the following topics:	3
	Introduction	
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks	
	Sequential logic: Flip-flops, automata, systematic hardware design Technological foundations.	
	 Technological foundations Computer arithmetic: Integer addition, subtraction, multiplication and division 	
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining	
	Memories: Memory hierarchies, SRAM, DRAM, caches	
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the phys	
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a collection	
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing systems - from	m gates and circi
	up to complete processors.	
	After successful completion of the module, the students are able to judge the interdependencies between a physical computer syste	em and the softwa
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-centric abs	straction layers fr
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels have or	n an entire syste
	performance and to propose feasible options.	
Personal Competence		
Personal Competence Social Competence		
Personal Competence Social Competence		
	Students are able to solve similar problems alone or in a group and to present the results accordingly.	
Social Competence	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.	
Social Competence Autonomy	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56	
Social Competence Autonomy Workload in Hours Credit points	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56	
Social Competence Autonomy Workload in Hours Credit points Examination	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs	
Social Competence Autonomy Workload in Hours Credit points Examination	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory	sory
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	•
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering	lsory eering: Compulso
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engine General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Engineering Sc	lsory eering: Compulso
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engine General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engine General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 seme	Isory eering: Compulso gineering Scienc
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compuls General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Micraft Systems Engine General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineerial Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science	Isory eering: Compulso gineering Scienc
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Technomathematics: Specialisation II. Informatics: Elective Compulsory



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

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

Тур	Recitation Section (small)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	
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 shifte
- 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
- 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



Courses	
itle	Typ Hrs/wk CP
ntroduction to Control Systems (L0654) ntroduction to Control Systems (L0655)	Lecture 2 4 Recitation Section (small) 2 2
Module Responsible	Prof. Herbert Werner
Admission Requirements	none
Recommended Previous	Representation of signals and systems in time and frequency domain, Laplace transform
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain properties of first and second
	systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.
	They can explain the role of the phase margin in analysis and synthesis of control loops
	They can explain the way a PID controller affects a control loop in terms of its frequency response
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally
Skills	Students can transform models of linear dynamic systems from time to frequency domain and vice versa
	They can simulate and assess the behavior of systems and control loops
	They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules
	They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks
Personal Competence	
Social Competence	
Autonomy	
	problems.
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.
	They can access their knowledge in recently on line tools and thereby control real integration.
	They can access their knowledge in recently on line tests and thereby control realining progress.
	They can access their knowledge in recently on line tests and thereby control inclining progress.
	They can access their knowledge in recently on line tests and thereby control it canning progress.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Workload in Hours Credit points	Independent Study Time 124, Study Time in Lecture 56
Credit points Examination	Independent Study Time 124, Study Time in Lecture 56 6 Written exam
Credit points	Independent Study Time 124, Study Time in Lecture 56 6 Written exam
Credit points Examination	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min
Credit points Examination Examination duration and scale	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
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Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory 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
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
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Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German p
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German p
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Elioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Elioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Elioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (Ompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Producompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engine
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Ovii Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focu
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Speciali
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Domputer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 Alicraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Reproductive: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Scien
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Domputer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 Alicraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Reproductive: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Scien
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Mritten exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechanical Integration Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Meterials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Meterials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Meterials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Eng
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 8 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Covil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 seme
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 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 Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory G
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program; Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanic
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 120 min Ceneral Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering; Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering, Focus 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 Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ Compulsory General Engineering Science (Engilish program, 7 semest



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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

Process Engineering: Core qualification: Compulsory

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



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



Module M0725: Production	Engineering			
Courses				
Title		Тур	Hrs/wk	СР
Production Engineering I (L0608)		Lecture	2	2
Production Engineering I (L0612)		Recitation Section (large)	1	1
Production Engineering II (L0610)		Lecture	2	2
Production Engineering II (L0611)		Recitation Section (large)	1	1
Module Responsible	Prof. Wolfgang Hintze			
Admission Requirements	none			
Recommended Previous	no course assessments required			
Knowledge	internship recommended			
Educational Objectives	After taking part successfully, students have reached the following lea	rning results		
Professional Competence				
Knowledge	Students are able to			
	 name basic criteria for the selection of manufacturing processe 	es.		
	 name the main groups of Manufacturing Technology. 			
	 name the application areas of different manufacturing process 			
	 name boundaries, advantages and disadvantages of the difference 			
	 describe elements, geometric properties and kinematic variab 	les and requirements for tools, workp	piece and process.	
	 explain the essential models of manufacturing technology. 			
Skills	Students are able to			
	select manufacturing processes in accordance with the require			
	design manufacturing processes for simple tasks to meet the r		t to be produced.	
	 assess components in terms of their production-oriented consi 	ruction.		
Personal Competence				
Social Competence	Students are able to			
	 develop solutions in a production environment with qualified p 	ersonner at technical level and repre	esent decisions.	
Autonomy	Students are able to			
	interpret independently the manufacturing process.			
	assess own strengths and weaknesses in general.			
	 assess their learning progress and define gaps to be improve 	d.		
	assess possible consequences of their actions.			
	•			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering	, Focus Theoretical N	Mechanical Engineering
Curricula	Elective Compulsory			
	General Engineering Science (German program, 7 semester): Spec	cialisation Mechanical Engineering,	Focus Product Devel	opment and Production
	Compulsory			
	General Engineering Science (English program, 7 semester): Spe	cialisation Mechanical Engineering	, Focus Theoretical M	Mechanical Engineering
	Elective Compulsory			
	General Engineering Science (English program, 7 semester): Spec	ialisation Mechanical Engineering,	Focus Product Devel	opment and Production
	Compulsory			
	Logistics and Mobility: Specialisation Engineering Science: Elective C	Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			



Course L0608: Production Engineer	ing I
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Wolfgang Hintze
Language	DE
Cycle	WiSe
Content	Manufacturing Accuracy Manufacturing Metrology Measurement Errors and Uncertainties Introduction to Forming Massiv forming and Sheet Metal Forming Introduction to Machining Technology Geometrically defined machining (Turning, milling, drilling, broaching, planning)
Literature	Dubbel, Heinrich (Grote, Karl-Heinrich.; Feldhusen, Jörg.; Dietz, Peter.; Ziegmann, Gerhard.;) Taschenbuch für den Maschinenbau : mit Tabellen. Berlin [u.a.] : Springer, 2007 Fritz, Alfred Herbert: Fertigungstechnik : mit 62 Tabellen. Berlin [u.a.] : Springer, 2004 Keferstein, Claus P (Dutschke, Wolfgang.;): Fertigungsmesstechnik : praxisorientierte Grundlagen, moderne Messverfahren. Wiesbaden : Teubner, 2008 Mohr, Richard: Statistik für Ingenieure und Naturwissenschaftler : Grundlagen und Anwendung statistischer Verfahren. Renningen : expert-Verl, 2008 Klocke, F., König, W.: Fertigungsverfahren Bd. 1 Drehen, Fäsen, Bohren. 8. Aufl., Springer (2008) Klocke, Fritz (König, Wilfried,;): Umformen. Berlin [u.a.] : Springer, 2006 Paucksch, E.: Zerspantechnik, Vieweg-Verlag, 1996 Tönshoff, H.K.; Denkena, B., Spanen. Grundlagen, Springer-Verlag (2004)

Course L0612: Production Engineering I		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Wolfgang Hintze	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0610: Production Engineer	ing II
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Wolfgang Hintze, Prof. Claus Emmelmann
Language	DE
Cycle	SoSe
Content	Geometrically undefined machining (grinding, lapping, honing) Introduction into erosion technology Introduction into blastig processes Introduction to the manufacturing process forming (Casting, Powder Metallurgy, Composites) Fundamentals of Laser Technology Process versions and Fundamentals of Laser Joining Technology
Literature	Klocke, F., König, W.: Fertigungsverfahren Bd. 2 Schleifen, Honen, Läppen, 4. Aufl., Springer (2005) Klocke, F., König, W.: Fertigungsverfahren Bd. 3 Abtragen, Generieren und Lasermaterialbearbeitung. 4. Aufl., Springer (2007) Spur, Günter (Stöferle, Theodor.;): Urformen. München [u.a.]: Hanser, 1981 Schatt, Werner (Wieters, Klaus-Peter,; Kieback, Bernd,;): Pulvermetallurgie: Technologien und Werkstoffe. Berlin [u.a.]: Springer, 2007



Course L0611: Production Engineering II		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Wolfgang Hintze, Prof. Claus Emmelmann	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1320: Simulation	and Design of Mechatronic Systems			
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 electrical engi	neering		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	Students are able to describe methods and calculations for des	ign, modeling, simulation and optimization	of mechatronic system	ns.
Skills	Students are able to apply modern algorithms for modeling	of mechatronic systems. They can identi	fy, simulate and des	ign simple systems and
	implement those in laboratory conditions.			
Personal Competence				
Social Competence	Students are able to work goal-oriented in small mixed groups	and present results to target groups.		
Autonomy	Students are able to recognize and improve knowledge deficits	independently.		
	With instructor assistance, students are able to evaluate their or	wn knowledge level and define a further co	urse of study.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		· · · · · · · · · · · · · · · · · · ·	
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	n Mechanical Engineering, Focus Mechatro	onics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation	n Mechanical Engineering, Focus Aircraft S	Systems Engineering:	Compulsory
	General Engineering Science (German program): Specialisation	* *		
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, Foo	cus Mechatronics: Cor	npulsory
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester		•	
	Elective Compulsory	,pan-an =g	,	
	General Engineering Science (English program): Specialisation	n Mechanical Engineering, Focus Aircraft St	vstems Engineering: (Compulsory
	General Engineering Science (English program): Specialisation			, , , , , , , , , , , , , , , , , , , ,
	General Engineering Science (English program): Specialisation			ering: Compulsory
	General Engineering Science (English program, 7 semester): S	•	-	
	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester).			
	Elective Compulsory	,. Specialisation modification Engineering.	, . 5005 111601611001 11	
	Mechanical Engineering: Specialisation Aircraft Systems Engin	eering: Compulsory		
	Mechanical Engineering: Specialisation Mechatronics: Computer Mechanical Engineering: Specialisation Mechatronics: Computer Mechatronics: Computer Mechanical Engineering: Specialisation Mechatronics: Computer Mechanical Engineering: Specialisation Mechatronics: Computer Mechanical Engineering: Specialisation Mechanical Engineeri			
	Mechanical Engineering: Specialisation Mechanical Engineering: Specialisation Theoretical Mechanical	•		
	Mechatronics: Core qualification: Compulsory	a Engineening. Compulsory		
	wiconationics. Oute qualification. Compulsory			

Course L1822: Simulation and Design of Mechatronic Systems		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	Mechatronic Design	
	Modeling	
	Model Identifikation	
	Numerical Methods in simulation	
	Applications and examples in Matlab [®] and Simulink [®]	
Literature	Skript zur Veranstaltung	
	Weitere Literatur in der Veranstaltung	



Course L1824: Simulation and Design of Mechatronic Systems		
Тур	Laboratory	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1823: Simulation and Design of Mechatronic Systems		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0854: Mathematic	es IV					
Courses						
Title		Ту	p	Hrs/wk	СР	
Differential Equations 2 (Partial Differential	Equations) (L1043)	Le	cture	2	1	
Differential Equations 2 (Partial Differential			ecitation Section (small)	1	1	
Differential Equations 2 (Partial Differential	Equations) (L1045)		ecitation Section (large)	1 2	1	
Complex Functions (L1038) Complex Functions (L1041)			cture ecitation Section (small)	1	1	
Complex Functions (L1042)			ecitation 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 f	ollowing learning res	ults			
Professional Competence						
Knowledge	 Students can name the basic concepts in Mathematics IV. 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 example They know proof strategies and can reproduce them. 					
Skills	 Students can model problems in Mathematics IV with the help of the concepts studied in this course. Moreover, they are capable of solving the by applying established methods. Students are able to discover and verify further logical connections between the concepts studied in the course. For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results. 					
Personal Competence						
Social Competence	 Students are able to work together in teams. They are 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 example 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 knowhere 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 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	General Engineering Science (German program): Special		ineering: Compulsory			
Curricula	General Engineering Science (German program): Special			cs: Compulsory		
	General Engineering Science (German program): Special		-		eering: Compulsory	
	General Engineering Science (German program): Special	lisation Naval Archite	cture: Compulsory	0	, ,	
	General Engineering Science (German program, 7 semes			sory		
	General Engineering Science (German program, 7 semes	ster): Specialisation M	lechanical Engineering, Focus	Mechatronics: Cor	npulsory	
	General Engineering Science (German program, 7 sen	nester): Specialisatio	n Mechanical Engineering, F	ocus Theoretical N	Mechanical Engineerin	
	Compulsory					
	General Engineering Science (German program, 7 semes	ster): Specialisation N	aval Architecture: Compulsory	/		
	Computer Science: Specialisation Computational Mathem	natics: Elective Comp	ulsory			
	Electrical Engineering: Core qualification: Compulsory					
	General Engineering Science (English program): Speciali	-				
	General Engineering Science (English program): Speciali					
	General Engineering Science (English program): Speciali					
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory					
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory					
	General Engineering Science (English program, 7 semes General Engineering Science (English program, 7 sem		-			
	Compulsory					
	General Engineering Science (English program, 7 semes	ter): Specialisation N	aval Architecture: Compulsory			
	Computational Science and Engineering: Specialisation E	Engineering Sciences	:: Elective Compulsory			
	Computational Science and Engineering: Specialisation (Computer Science: El	ective Compulsory			
	Mechanical Engineering: Specialisation Theoretical Mechanical Engineering: Compulsory					
	Mechanical Engineering: Specialisation Mechatronics: Compulsory					
	Mechatronics: Core qualification: Compulsory					
	Naval Architecture: Core qualification: Compulsory		Ole disease File di Consti			
	Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory					



Course L1043: Differential Equations 2 (Partial Differential Equations)		
Тур	Lecture	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	Main features of the theory and numerical treatment of partial differential equations	
1 Paradora	 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
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



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	Troblem-based Learning		3
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following lear	ning results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of many Marketing and Innovation, and also to Investment and Controlling. In p		nagement, from Plan	ning and Organisation
	 explain the differences between Economics and Management field of Management 	and the sub-disciplines in Managem	nent and to name impo	ortant definitions from t
	explain the most important aspects of and goals in Managemer	at and name the most important aspe	ects of entreprneurial	orojects
	describe and explain basic business functions as production,			
	ressource management, information management, innovation r	nanagement and marketing		
	 explain the relevance of planning and decision making in Bu 	siness, esp. in situations under mu	ultiple objectives and	uncertainty, and expla
	some basic methods from mathematical Finance			
	 state basics from accounting and costing and selected controlli 	ng methods.		
Skills	Students are able to analyse business units with respect to diff Entrepreneurship project in a team. In particular, they are able to	ferent criteria (organization, object	ctives, strategies etc	.) and to carry out
	analyse Management goals and structure them appropriately			
	analyse organisational and staff structures of companies			
	 apply methods for decision making under multiple objectives, u 	nder uncertainty and under risk		
	analyse production and procurement systems and Business inf	ormation systems		
	 analyse and apply basic methods of marketing 			
	select and apply basic methods from mathematical finance to p			
	 apply basic methods from accounting, costing and controlling to 	predefined problems		
Personal Competence				
Social Competence	Students are able to			
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepreneurshi	p 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): Specialisation Electronic Specialistic Specialisation Electronic Specialistic Specialisti	rical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Comp			
	General Engineering Science (German program): Specialisation Proce			
	General Engineering Science (German program): Specialisation Biopr General Engineering Science (German program): Specialisation Energ	0 0 1 ,	ompulson/	
	General Engineering Science (German program): Specialisation Civil-	,,	. ,	
	General Engineering Science (German program): Specialisation Mech		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
	General Engineering Science (German program): Specialisation Biom	edical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Nava	Architecture: Compulsory		
	General Engineering Science (German program, 7 semester): Speciali			
	General Engineering Science (German program, 7 semester): Speciali		-	
	General Engineering Science (German program, 7 semester): Speciali			
	General Engineering Science (German program, 7 semester): Speciali General Engineering Science (German program, 7 semester): Speciali	·	•	
	General Engineering Science (German program, 7 semester): Specialis	·	-	
	General Engineering Science (German program, 7 semester): Speciali			
	General Engineering Science (German program, 7 semester): Speciali		•	у
	General Engineering Science (German program, 7 semester): Speciali	sation Mechanical Engineering, Foo	cus Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semester): Speciali			
	General Engineering Science (German program, 7 semester): Speciali		•	
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering	g, Focus Materials ir	Engineering Science
	Compulsory General Engineering Science (German program, 7 semester): Spec	galisation Mechanical Engineering	Focus Theoretical M	Achanical Engineeri



Compulsory

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

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

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

Energy and Environmental Engineering: Core qualification: Compulsory

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

Mechanical Engineering: Core qualification: Compulsory

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

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



	Lecture	
Typ 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. Wol	
20010101	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.	

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	
Language	DE	
Cycle	WiSe/SoSe	
Content	In this project module, students work on an Entrepreneurship project. They are required to go through all relevant steps, from the first idea to the concept, using their knowledge from the corresponding lecture. Project work is carried out in teams with the support of a mentor.	
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.	



Specialization Biomedical Engineering

The requirements into the health system increase continuously due to the aging population and the increasing expectations for the quality in life. A major aspect in this development is medical technology. This ranges from individual implants and prostheses to complex imaging and therapy equipment and its operation. Medical specialists and well educated engineers will have to cooperate closer and closer to understand the requirements from either side and develop solutions together. In order to cooperate, the engineers need in addition to their core engineering skills, a basic understanding of the "other" fields, which are Medicine and Economy. This enables them to understand operational planning as well as research and development in this highly interdisciplinary area. The program is aimed towards allowing the students to achieve these qualifications.

	Тур	Hrs/wk	СР
	Lecture	2	2
	Lecture	2	2
ce (L1095)	Lecture	2	2
school-level physics, chemistry und mathematics			
taking part successfully, students have reached the following	ng learning results		
students have acquired a fundamental knowledge on	metals, ceramics and polymers as	nd can describe this knowl	ledge comprehensively
Fundamental knowledge here means specifically the issues of atomic structure, microstructure, phase diagrams, phase transformations, corrosion a			
nanical properties. The students know about the key asp	ects of characterization methods for	materials and can identify	relevant approaches fo
acterizing specific properties. They are able to trace materia	als phenomena back to the underlyin	g physical and chemical law	rs of nature.
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		onditions and the materials	microstructure, and the
account for the impact of microstructure on the material's be	navior.		
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Course L1085: Fundamentals of Materials Science I		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Jörg Weißmüller	
Language	DE	
Cycle	WiSe	
Content		
Literature	Vorlesungsskript	
	W.D. Callister: Materials Science and Engineering - An Introduction. 5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7	

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

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



Courses	
Title	Typ Hrs/wk CP
Computer Engineering (L0321) Computer Engineering (L0324)	Lecture 3 4 Recitation Section (small) 1 2
Module Responsible	
Admission Requirements	
Recommended Previous	
Knowledge	
	The successful completion of the labs will be honored during the evaluation of the module's examination according to the following rules:
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the successful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	
	gates. The module includes the following topics:
	• Introduction
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks
	 Sequential logic: Flip-flops, automata, systematic hardware design Technological foundations
	Computer arithmetic: Integer addition, subtraction, multiplication and division
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining
	Memories: Memory hierarchies, SRAM, DRAM, caches
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the physical composition of the students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the physical composition of the students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the physical composition of the structure and the stru
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a collection of few and s
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing systems - from gates and ci up to complete processors.
	ap to complete processors.
	After successful completion of the module, the students are able to judge the interdependencies between a physical computer system and the sof
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-centric abstraction layers
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels have on an entire sys
	performance and to propose feasible options.
Personal Competence	
Social Competence	Students are able to solve similar problems alone or in a group and to present the results accordingly.
Autonomy	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Examination	Written exam
Examination duration and scale	90 minutes, contents of course and labs
Assignment for the Following	General Engineering Science (German program): Core qualification: Compulsory
Curricula	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation 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 Mechanics: 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 Biomedianics. Computings of General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compu
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
	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 Produ
	Compulsory
	Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Computer Science: Core qualification: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

Technomathematics: Specialisation II. Informatics: Elective Compulsory



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

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

Тур	Recitation Section (small)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	
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
	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



- 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 shifte
- 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
- 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 M0680: Fluid Dynar	nice			
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Courses				
Title		Тур	Hrs/wk	СР
Fluid Mechanics (L0454)		Lecture	3	4
Fluid Mechanics (L0455)		Recitation Section (large)	2	2
Module Responsible	Prof. Thomas Rung			
Admission Requirements	none			
Recommended Previous	Sound knowledge of engineering mathematics, engineering me	echanics and thermodynamics.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	Students will have the required sound knowledge to explain the	e general principles of fluid engineering an	d physics of fluids. S	Students can scientificall
	outline the rationale of flow physics using mathematical mode	s and are familiar with methods for the per	formance analysis a	and the prediciton of fluid
	engineering devices.			
Skills	Students are able to apply fluid-engineering principles and flow	s-physics models for the analysis of technics	al evetame. The lectu	ira anablae tha etiidant te
OKIIIS	Students are able to apply fluid-engineering principles and flow-physics models for the analysis of technical systems. The lecture enables the studer carry out all necessary theoretical calculations for the fluid dynamic design of engineering devices on a scientific level.			
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Personal Competence				
Social Competence	The students are able to discuss problems and jointly develop s	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): Specialisatio	n Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisatio	n Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisatio	, ,		
	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester): S		ry	
	General Engineering Science (English program): Specialisation			
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	General Engineering Science (English program): Specialisation	• •	nulcon	
	General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S			
	Computational Science and Engineering: Specialisation Engine		y	
	Mechanical Engineering: Core qualification: Compulsory	John Goldings . Elective Compulsory		
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: El	ective Compulsory		
	and the second s			

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



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



ourses			
	Trus Hestels OR		
tte	Typ Hrs/wk CP Lecture 3 4		
gnals and Systems (L0432) gnals 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 exp		
	Further experience with spectral transformations (Fourier series, Fourier transform, Laplace transform) is useful but not required.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
Knowledge	The students are able to classify and describe signals and linear time-invariant (LTI) systems using methods of signal and system theory. They are		
	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse determinist and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image domain valued by the transition of a continuous-time signal to a discrete-time signal.		
Skills	The students are able to describe and analyse deterministic signals and linear time-invariant systems using methods of signal and system theory		
	can analyse and design basic systems regarding important properties such as magnitude and phase response, stability, linearity etc They can a		
	the impact of LTI systems on the signal properties in time and frequency domain.		
Personal Competence			
Social Competence	The students can jointly solve specific problems.		
Autonomy	The students are able to acquire relevant information from appropriate literature sources. They can control their level of knowledge during the		
Autonomy	period by solving tutorial problems, software tools, clicker system.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Examination	Written exam		
Examination duration and scale	90 min		
Assignment for the Following	General Engineering Science (German program): Specialisation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Computer Science: Compulsory		
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Civil- and Enviromental Engeneering: Compulsory		
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Comp		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sci		
	Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering		
	Compulsory		
	Computer Science: Core qualification: Compulsory		
	Electrical Engineering: Core qualification: Compulsory		
	General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory		
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Computer Science: Compulsory		
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory General Engineering Science (English program): Specialisation Process 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 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering Engineering		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compu		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sci		
	Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering		
	Compulsory		
	Computational Science and Engineering: Core qualification: Compulsory		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Typ 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 • Concolution • Power and energy of signals • Correlation functions of deterministic signals • Linear time-invariant (LTI) systems • Signal transformations:	
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 • Concevolution • Power and energy of signals • Correlation functions of deterministic signals • Linear time-invariant (LTI) systems	
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	
Lecturer Prof. Gerhard Bauch Language DE/EN Cycle SoSe Content Basic classification and description of continuous-time and discrete-time signals and systems Concevolution Power and energy of signals Correlation functions of deterministic signals Linear time-invariant (LTI) systems	
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Content Basic classification and description of continuous-time and discrete-time signals and systems Concevolution Power and energy of signals Correlation functions of deterministic signals Linear time-invariant (LTI) systems	
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 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 	
 Power and energy of signals Correlation functions of deterministic signals Linear time-invariant (LTI) systems 	
Correlation functions of deterministic signals Linear time-invariant (LTI) systems	
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	



	IV (Kinetics II, Oscillations, Analytical Mechan			
Courses				
Title		Тур	Hrs/wk	СР
Mechanics IV (Kinetics II, Oscillations, An	alytical Mechanics, Multibody Systems) (L1137)	Lecture	3	3
	alytical Mechanics, Multibody Systems) (L1138)	Recitation Section (small)	2	2
	alytical Mechanics, Multibody Systems) (L1139)	Recitation Section (large)	1	1
Module Responsible	Prof. Robert Seifried			
Admission Requirements	none			
Recommended Previous	Mathematics I-III and Mechanics I-III			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the 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 / mechanical analysis and model formation, and apply 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 proble	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	se.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisati	on Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisati			
Januar	General Engineering Science (German program): Specialisati			
	General Engineering Science (German program, 7 semester):		mpulsorv	
	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	on Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation	on Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering: Com	npulsory	
	General Engineering Science (English program, 7 semester):	Specialisation Biomedical Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester):	Specialisation Naval Architecture: Compulso	ry	
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: I	Elective 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 (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1277: MED I: Intro	oduction to Anatomy			
Courses				
Title	Typ Hrs/wk CP			
Introduction to Anatomy (L0384)	Lecture 2 3			
Module Responsible	Prof. Udo Schumacher			
Admission Requirements	None			
Recommended Previous	None			
Knowledge	Notice			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence	This along part succession, succession have reactive are following realiting reaction.			
Knowledge				
Momeage	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 relevant 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 t relevant knowledge themselves.			
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28			
Credit points	3			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory			
Curricula	General Engineering Science (German program): 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			



Course L0384: Introduction to Anato	omy
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Tobias Lange
Language	
Cycle	
Content	General Anatomy 1st week: The Eucaryote Cell 2nd 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



irses					
)	(4.0000)	Тур	Hrs/wk CP		
duction to Radiology and Radiation Th		Lecture	2 3		
Module Responsible Admission Requirements	Prof. Ulrich Carl None		_		
Recommended Previous	None				
Knowledge					
Educational Objectives	After taking part successfully, students have reached the	he following learning results			
Professional Competence					
Knowledge	Thorany				
	Therapy				
	The students can distinguish different types of currentl	y used equipment with respect to its use in radia	ation therapy.		
	The students can explain complex treatment plans use	ed in radiation therapy in interdisciplinary conte	xts (e.g. surgery, internal medicine).		
	The students can describe the patients' passage from	their initial admittance through to follow-up care) .		
	Diagnostics				
	The students can illustrate the technical base conce imaging techniques (CT, MRT, US).	epts of projection radiography, including angi-	ography and mammography, 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 ne	eds.		
	The student can explain the influence of technical erro	ors on the imaging techniques.			
	The student can draw the right conclusions based on t	the images' diagnostic findings or the error prote	ncol		
	The stadent dan draw the right denotations based on t	the images diagnosis intange of the error prote			
Skills	Thorany				
	Therapy				
	The students can distinguish curative and palliative situations and motivate why they came to that conclusion.				
	The students can develop adequate therapy concepts and relate it to the radiation biological aspects.				
	The students can use the therapeutic principle (effects vs adverse effects)				
	The students can distinguish different kinds of radiation, can choose the best one depending on the situation (location of the tumor) and choose the energy needed in that situation (irradiation planning).				
	The student can assess what an individual psychosol social services, psycho-oncology).	cial service should look like (e.g. follow-up trea	atment, sports, social help groups, self-help grou		
	Diagnostics				
	The students can suggest solutions for repairs of imag	sing instrumentation after having done error and	llyeac		
	The students can classify results of imaging technique pathophysiology.	es according to different groups of diseases ba	sed on their knowledge of anatomy, pathology		
Personal Competence					
Social Competence					
	The students can assess the special social situation of	f tumor patients and interact with them in a profe	essional way.		
	The students are aware of the special, often fear-domi	inated behavior of sick people caused by diagn	ostic and therapeutic measures and can meet th		
	appropriately.				
Autonomy					
, is 6.1.511y	The students can apply their new knowledge and skills	s to a concrete therapy case.			
	The students can introduce younger students to the cli	inical daily routine.			
	The students are able to access anatomical knowle	edge by themselves, can participate competer	ntly in conversations on the topic and acquire		
	relevant knowledge themselves.	, , , , , , , , , , , , , , , , , , ,	,		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28				
Credit points	3				
Examination	Written exam				
Examination duration and scale	90 minutes General Engineering Science (German program): Spe	erialisation Mechanical Engineering Focus Pier	mechanics: Compulsory		
	General Engineering Science (German program): Spe General Engineering Science (German program): Spe	• •	• •		
Assignment for the Following Curricula	General Engineering Science (German program, 7 ser				
		moster): Specialisation Machanical Engineering	a Focus Biomechanics: Compulsory		
	General Engineering Science (German program, 7 ser	mester). Specialisation Mechanical Engineering	g, roddo Biornodriamod: Gompalodry		
	Electrical Engineering: Specialisation Medical Techno	ology: Elective Compulsory	, ,		
	Electrical Engineering: Specialisation Medical Techno General Engineering Science (English program): Spec	ology: Elective Compulsory cialisation Mechanical Engineering, Focus Bion	nechanics: Compulsory		
	Electrical Engineering: Specialisation Medical Techno	ology: Elective Compulsory cialisation Mechanical Engineering, Focus Bion cialisation Biomedical Engineering: Compulsor	mechanics: Compulsory		



Mechanical Engineering: Specialisation Biomechanics: Compulsory
Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory
Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory
Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory
Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory
Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0383: Introduction to Radio	ology and Radiation Therapy
Тур	Lecture
Hrs/wk	2
CP	
Workload in Hours Lecturer	Independent Study Time 62, Study Time in Lecture 28 Prof. Ulrich Carl, Prof. Thomas Vestring
Language	DE
Cycle	SoSe
Content	The students will be given an understanding of the technological possibilities in the field of medical imaging, interventional radiology and radiation therapy/radiation oncology. It is assumed, that students in the beginning of the course have heard the word "X-ray" at best. It will be distinguished between the two arms of diagnostic (Prof. Dr. med. Thomas Vestring) and therapeutic (Prof. Dr. med. Ulrich Carl) use of X-rays. Both arms depend on special big units, which determine a predefined sequence in their respective departments
Literature	"Technik der medizinischen Radiologie" von T. + J. Laubenberg –
	7. Auflage – Deutscher Ärzteverlag – erschienen 1999
	"Klinische Strahlenbiologie" von Th. Herrmann, M. Baumann und W. Dörr –
	4. Auflage - Verlag Urban & Fischer – erschienen 02.03.2006
	ISBN: 978-3-437-23960-1
	"Strahlentherapie und Onkologie für MTA-R" von R. Sauer –
	5. Auflage 2003 - Verlag Urban & Schwarzenberg – erschienen 08.12.2009
	ISBN: 978-3-437-47501-6
	"Taschenatlas der Physiologie" von S. Silbernagel und A. Despopoulus
	8. Auflage – Georg Thieme Verlag - erschienen 19.09.2012
	ISBN: 978-3-13-567708-8
	"Der Körper des Menschen " von A. Faller u. M. Schünke -
	16. Auflage 2004 - Georg Thieme Verlag - erschienen 18.07.2012
	ISBN: 978-3-13-329716-5
	"Praxismanual Strahlentherapie" von Stöver / Feyer –
	1. Auflage - Springer-Verlag GmbH – erschienen 02.06.2000



Module M0598: Mechanica	Engineering: Design				
Courses					
Title		Тур	Hrs/wk	CP	
Embodiment Design and 3D-CAD (L0268)		Lecture	2	1	
Mechanical Design Project I (L0695)		Practical Course	3	2	
Mechanical Design Project II (L0592)		Practical Course	3	2	
Team Project Design Methodology (L0267	')	Problem-based Learning	2	1	
Module Responsible	Prof. Dieter Krause				
Admission Requirements	None				
Recommended Previous					
Knowledge	Fundamentals of Mechanical Engineering Design				
	Mechanics				
	 Fundamentals of Materials Science 				
	Production Engineering				
Educational Objectives	After taking part successfully, students have reached the followin	g learning results			
Professional Competence		·			
Knowledge	After passing the module, students are able to:				
<u> </u>					
	 explain design guidelines for machinery parts e.g. consid 	ering 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:				
	a independently greate electrical drawings and decumentations or uning 2D CAD				
	independently create sketches, technical drawings and documentations e.g. using 3D CAD, design approach based on design spiritelines extraorrough.				
	design components based on design guidelines autonomously, dimposion (calculate) used components				
	 dimension (calculate) used components, use methods to design and solve engineering design tasks systamtically and solution-oriented, 				
		ks systamically 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. 				
	moderate the use of scientific methods,				
	present and discuss solutions and technical drawings wit reflect the gave regular in the work groups of the gaves.	nin groups,			
	 reflect the own results in the work groups of the course. 				
Autonomy	Students are able				
	to estimate their level of knowledge using activating met	hods 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		Compulsory		
Curricula	General Engineering Science (German program): Specialisation				
	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 Environmental Engineering: Compulsory				
	Energy and Environmental Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation	Energy and Enviromental Engineering: C	ompulsory		
	General Engineering Science (English program): Specialisation				
	General Engineering Science (English program): Specialisation	Biomedical Engineering: Compulsory			
	General Engineering Science (English program, 7 semester): Sp	ecialisation Mechanical Engineering: Co	mpulsory		
	General Engineering Science (English program, 7 semester): Sp	ecialisation Biomedical Engineering: Cor	npulsory		
	General Engineering Science (English program, 7 semester): Sp	ecialisation Energy and Enviromental En	gineering: Compulsor	у	
	Mechanical Engineering: Core qualification: Compulsory				
	Mechatronics: Core qualification: Compulsory				
	Naval Architecture: Core qualification: Compulsory				



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

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



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

Course L0267: Team Project Design	n Methodology			
Тур	Problem-based Learning			
Hrs/wk	2			
CP				
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-Ill; 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 			



Martin Moodo Blot Land	at a sect Table				
Module M0646: BIO I: Impla	ints and Testing				
Courses					
Fitle		Тур	Hrs/wk	CP	
Experimental Methods in Biomechanics (L	0377)	Lecture	2	3	
mplants and Fracture Healing (L0376)		Lecture	2	3	
Module Responsible	Prof. Michael Morlock				
Admission Requirements	None				
Recommended Previous	It is recommended to participate in "Implantate und Frakturheile	ung" before attending "Experimentelle N	Methoden".		
Knowledge					
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results			
Professional Competence					
Knowledge	The students can describe the different ways how bones heal,	and the requirements for their existence	е.		
	The students can name different treatments for the spine and h	ollow bones under given fracture morp	hologies.		
	The students can describe different measurement techniques f	or forces and movements, and choose	the adequate technique for	a given task.	
Skills	The students can determine the forces acting within the human	body under quasi-static situations und	ler specific assumptions.		
	The students can describe the basic handling of several experimental techniques used in biomechanics.				
Personal Competence					
Social Competence	The students can, in groups, solve basic experimental tasks.				
Autonomy	The students can, in groups, solve basic experimental tasks.				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56				
Credit points	6				
Examination	Written exam				
Examination duration and scale	90 minutes, many questions				
Assignment for the Following	General Engineering Science (German program): Specialisation	on Mechanical Engineering, Focus Bior	mechanics: Compulsory		
Curricula	General Engineering Science (German program): Specialisation				
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory				
	Mechanical Engineering: Specialisation Biomechanics: Compulsory				
	Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory				
	Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory				
	Biomedical Engineering: Specialisation Medical Technology a		у		
	Biomedical Engineering: Specialisation Management and Bus		•		

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



Course L0376: Implants and Fractur	re Healing	
-	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Michael Morlock	
Language	DE M60	
	Topics to be covered include:	
	Introduction (history, definitions, background importance)	
	2. Bone (anatomy, properties, biology, adaptations in femur, tibia, humerus, radius)	
	3. Spine (anatomy, biomechanics, function, vertebral bodies, intervertebral disc, ligaments)	
	3.1 The spine in its entirety	
	3.2 Cervical spine	
	3.3 Thoracic spine	
	3.4 Lumbar spine	
	3.5 Injuries and diseases	
	4. Pelvis (anatomy, biomechanics, fracture treatment)	
	5 Fracture Healing	
	5.1 Basics and biology of fracture repair	
	5.2 Clinical principals and terminology of fracture treatment	
	5.3 Biomechanics of fracture treatment	
	5.3.1 Screws	
	5.3.2 Plates	
	5.3.3 Nails	
	5.3.4 External fixation devices	
	5.3.5 Spine implants	
	6.0 New Implants	
Literature	Cochran V.B.: Orthopādische Biomechanik	
	Mow V.C., Hayes W.C.: Basic Orthopaedic Biomechanics	
	White A.A., Panjabi M.M.: Clinical biomechanics of the spine	
	Nigg, B.: Biomechanics of the musculo-skeletal system	
	Schiebler T.H., Schmidt W.: Anatomie	
	Platzer: dtv-Atlas der Anatomie, Band 1 Bewegungsapparat	



Module M0662: Numerical	Mathematics I			
ourses				
tle		Тур	Hrs/wk	СР
umerical Mathematics I (L0417)		Lecture	2	3
umerical Mathematics I (L0418)		Recitation Section (small)	2	3
Module Responsible	Prof. Sabine Le Borne			
Admission Requirements	None			
Recommended Previous Knowledge	Mathematik I + II for Engineering Students (german or basic MATLAB knowledge	english) or Analysis & Linear Algebra I + II for	r Technomathematicia	ans
Educational Objectives	After taking part successfully, students have reached the follo	wing 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 explain aspects.	nods,		finding problems and
Skills	Students are able to			
	implement, apply and compare numerical methods us justify the convergence behaviour of numerical metho select and execute a suitable solution approach for a	ds with respect to the problem and solution al	gorithm,	
Personal Competence				
Social Competence	Students are able to			
Autonomy	work together in heterogeneously composed teams (foundations and support each other with practical asp Students are capable to assess whether the supporting theoretical and prac to assess their individual progess and, if necessary, to	ects regarding the implementation of algorithr	ms.	dge), explain theoretion
	to access area marvidua progess and, in recessary, to	active questions and seek morp.		
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	ion Mechanical Engineering, Focus Biomech	anics: Compulsory	
	General Engineering Science (German program): Specialisat	ion Mechanical Engineering, Focus Materials	in Engineering Scier	nces: Compulsory
	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program, 7 semester)	·	•	
	General Engineering Science (German program, 7 semes	ter): Specialisation Mechanical Engineering	g, Focus Materials in	Engineering Science
	Compulsory General Engineering Science (German program, 7 semester)	· Specialization Biomodical Engineering: Con	nnulcon	
	General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semester)			mouleon
	Bioprocess Engineering: Specialisation A - General Bioproce		da biomechanica. Oo	Призоту
	Computer Science: Specialisation Computational Mathematic			
	Electrical Engineering: Core qualification: Elective Compulso			
	General Engineering Science (English program): Specialisati	on Computer Science: Compulsory		
	General Engineering Science (English program): Specialisati	on Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Biomecha	anics: Compulsory	
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Materials	in Engineering Scien	ces: Compulsory
	General Engineering Science (English program, 7 semester):	·	•	
	General Engineering Science (English program, 7 semes	ter): Specialisation Mechanical Engineering	, Focus Materials in	Engineering Science
	Compulsory	Openialization Dispositive Factor of		
	General Engineering Science (English program, 7 semester): General Engineering Science (English program, 7 semester):			mouleory
	Computational Science and Engineering: Core qualification:		as biomedianics. G01	пригосту
	Process Engineering: Specialisation Process Engineering: El			

Process Engineering: Specialisation Process Engineering: Elective 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	
Language	DE	
Cycle	WiSe	
Content	 Error analysis: Number representation, error types, conditioning and stability Interpolation: polynomial and spline interpolation Numerical integration and differentiation: order, Newton-Cotes formula, error estimates, Gaussian quadrature, adaptive quadrature, difference formulas Linear systems: LU and Cholesky factorization, matrix norms, conditioning Linear least squares problems: normal equations, Gram.Schmidt and Householder orthogonalization, singular value decomposition, regularization Eigenvalue problems: power iteration, inverse iteration, QR algorithm Nonlinear systems of equations: Fixed point iteration, root-finding algorithms for real-valued functions, Newton and Quasi-Newton methods for systems 	
Literature	Stoer/Bulirsch: Numerische Mathematik 1, Springer Dahmen, Reusken: Numerik für Ingenieure und Naturwissenschaftler, Springer	

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



Module M0684: Heat Trans	fer en			
Courses				
		Tun	Heo hade	CP
Title		Тур	Hrs/wk 3	
Heat Transfer (L0458) Heat Transfer (L0459)		Lecture Recitation Section (large)	2	5 1
Module Responsible	Dr. Andreas Moschallski	riecitation Section (large)		
Admission Requirements	none			
Recommended Previous	Technical Thermodynamics I, II and Fluid Dynamics			
Knowledge	· · · · · · · · · · · · · · · · · · ·			
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence	3,,	3		
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 app	proach.		
Autonomy	The students are able to develop a complex problem self-consistent	and analyse the results in a critical wa	av A qualified evolun	no with other students is
Autonomy	given.	and analyse the results in a childar wa	ay. A qualified excitati	ge with other students is
	9.70			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Biomech	anics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Energy S	ystems: Compulsory	
	General Engineering Science (German program): Specialisation Bio	medical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Theoretic	al Mechanical Engine	ering: Compulsory
	General Engineering Science (German program, 7 semester): Speci	alisation Mechanical Engineering, Foc	us Energy Systems: C	ompulsory
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineering,	Focus Theoretical M	lechanical Engineering:
	Compulsory			
	General Engineering Science (German program, 7 semester): Speci	alisation Biomedical Engineering: Con	npulsory	
	General Engineering Science (English program): Specialisation Biol	medical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Med	chanical Engineering, Focus Biomecha	anics: Compulsory	
	General Engineering Science (English program): Specialisation Med			
	General Engineering Science (English program): Specialisation Med			
	General Engineering Science (English program, 7 semester): Specia			
	General Engineering Science (English program, 7 semester): Sp Compulsory	ecialisation Mechanical Engineering,	Focus Theoretical M	lechanical Engineering:
	General Engineering Science (English program, 7 semester): Specia	alisation Biomedical Engineering: Com	inulsory	
	Mechanical Engineering: Specialisation Energy Systems: Compulso		ipai30i y	
	Mechanical Engineering: Specialisation Theoretical Mechanical Engineering: Specialisation Theoretical Mechanical Engineering:			
		9 p - 1		

Course L0458: Heat Transfer	
Тур	Lecture
Hrs/wk	3
CP	5
Workload in Hours	Independent Study Time 108, 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	1
Workload in Hours	Independent Study Time 2, 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	СР
Practical Course: Measurement and Contr	rol Systems (L1119)	Laboratory Course	2	2
Measurement Technology for Mechanical	and Process Engineers (L1116)	Lecture	2	3
Measurement Technology for Mechanical	and Process Engineers (L1118)	Recitation Section (large)	1	1
Module Responsible	Dr. Sven Krause			
Admission Requirements	none			
Recommended Previous	Basic knowledge of physics, chemistry and electrical engineeri	ng		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge				, Calibration, Static a
	Dynamic Properties of Sensors and Systems).			
	They can outline the most important measuring methods for di	forest kinds of quantities to be massured	Electrical Quantities	Comporaturo mochani
	quantities, Flow, Time, Frequency).	lerent kinds of quantities to be maesured (Liectrical Quartities,	remperature, mechani
	qualitues, flow, fille, frequency).			
	They can describe important methods of chemical Analysis (Ga	s Sensors, Spectroscopy, Gas Chromatogo	raphy)	
Skills	Students can select suitable measuring methods to given probl	ems and can use refering measurement de	evices in practice.	
	The students are able to orally explain issues in the subject ar	ea of measurement technology and solution	on approaches as wel	as place the issues
	the right context and application area.			
Personal Competence				
Social Competence	Students can arrive at work results in groups and document the	m in a common report.		
Autonomy	Students are able to familiarize themselves with new measurer	nent technologies.		
		-		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	105 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation		Compulsory	
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester):			У
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (German program, 7 semester):		uisory	
	Energy and Environmental Engineering: Core qualification: Co	,	ompulaan.	
	General Engineering Science (English program): Specialisation	•	ompulsory	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): S		aineering: Compulsor	v
	General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S			у
	General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S		. ,	
	General Engineering Science (English program, 7 semester): S			
	Mechanical Engineering: Core qualification: Compulsory	pooransauon i 100ess Engineening. Compi	21001 y	
	Mechatronics: Core qualification: Compulsory			



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



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

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



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

e L0654: Introduction to Contr	ol Systems	
Тур	Lecture	
Hrs/wk	2	
СР	4	
Workload in Hours	dependent Study Time 92, Study Time in Lecture 28	
Lecturer	Prof. Herbert Werner	
Language	DE	
Cycle	WiSe	
Content	Signals and systems	
	Linear systems, differential equations and transfer functions	
	First and second order systems, poles and zeros, impulse and step response	
	Stability	
	Feedback systems	
	Principle of feedback, open-loop versus closed-loop control	
	Reference tracking and disturbance rejection	
	Types of feedback, PID control	
	System type and steady-state error, error constants	
	Internal model principle	
	Root locus techniques	
	Root locus plots	
	Root locus design of PID controllers	
	Frequency response techniques	
	Bode diagram	
	Minimum and non-minimum phase systems	
	Nyquist plot, Nyquist stability criterion, phase and gain margin	
	Loop shaping, lead lag compensation	
	Frequency response interpretation of PID control	
	Time delay systems	
	Root locus and frequency response of time delay systems	
	Smith predictor	
	Digital control	
	Sampled-data systems, difference equations	
	Tustin approximation, digital implementation of PID controllers	
	Software tools	
	Introduction to Matlab, Simulink, Control toolbox	
	Computer-based exercises throughout the course	
	Company according to the control of	
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"	
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009	
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010	
	- 14. Ogala Modern Soniter Engineening , Fourth Edition, Frentice Hair, Opper Saudie Hiver, No. 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



lodule M1279: MED II: Intr	oduction to Biochemistry and Mole	cular Biology		
ourses				
le		Тур	Hrs/wk	CP
roduction to Biochemistry and Molecula	r Biology (L0386)	Lecture	2	3
Module Responsible	Prof. Hans-Jürgen Kreienkamp			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have rea	ached the following learning results		
Professional Competence				
Knowledge				
	The students can			
	 describe basic biomolecules; 			
	explain how genetic information is code	ed in the DNA:		
	explain the connection between DNA as			
	onplant are semicoden potation by a car	na protomo,		
Skills				
	The students can			
	recognize the importance of molecular parts.	parameters for the course of a disease:		
	describe different molecular-diagnostic			
	describe the importance of those treatments for	some diseases;		
Personal Competence				
Social Competence				
Coolai Competendo	The students can conduct discussions in resea	rch and medicine on a technical level		
Autonomy	The students can develop understanding of top	ics from the course, using technical literature, by thems	elves	
Workload in Hours	Independent Study Time 62, Study Time in Lec	ture 28		
Credit points	3			
Examination	Written exam			
Examination duration and scale	60 minutes			
Assignment for the Following Curricula		n): Specialisation Mechanical Engineering, Focus Bion		
Curricula		n): Specialisation Biomedical Engineering: Compulsory		
		m, 7 semester): Specialisation Biomedical Engineering:		nnulcon/
	Electrical Engineering: Specialisation Medical	m, 7 semester): Specialisation Mechanical Engineering Technology: Elective Compulsory	, i ocas biomechanics. Con	призоту
		n): Specialisation Mechanical Engineering, Focus Biom	echanics: Compulsory	
		n): Specialisation Mechanical Engineering, Focus Blom		
		n, 7 semester): Specialisation Mechanical Engineering,		npulsory
		n, 7 semester): Specialisation Biomedical Engineering:		
	Mechanical Engineering: Specialisation Biome		1- 0-0-0-1	
	* * '	ement and Business Administration: Elective Compulso	ory	
		al Organs and Regenerative Medicine: Elective Comput	•	
		al Technology and Control Theory: Elective Compulsory		
	Biomedical Engineering: Specialisation Implan			
	Technomathematics: Core qualification: Electiv			
	Technomathematics: Specialisation III. Enginee	rina Caianas Flactiva Camarulana		

Course L0386: Introduction to Bioch	Course L0386: Introduction to Biochemistry and Molecular Biology		
Тур	Lecture		
Hrs/wk	2		
СР	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Hans-Jürgen Kreienkamp		
Language	DE		
Cycle	WiSe		
Content			
Literature	Müller-Esterl, Biochemie, Spektrum Verlag, 2010; 2. Auflage		
	Löffler, Basiswissen Biochemie, 7. Auflage, Springer, 2008		



courses				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880) roject Entrepreneurship (L0882)		Lecture Problem-based Learning	3	3
Module Responsible	Prof. Christoph Ihl	1 Tobletti-based Learning	2	3
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning	ig results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of many dif Marketing and Innovation, and also to Investment and Controlling. In part		nagement, from Plani	ning and Organisation
	explain the differences between Economics and Management and	d the sub-disciplines in Managen	nent and to name impo	ortant definitions from t
	field of Management			
	explain the most important aspects of and goals in Management a			
	 describe and explain basic business functions as production, pr ressource management, information management, innovation ma 		chain management,	organization and hum
	explain the relevance of planning and decision making in Busin		ultiple objectives and	uncertainty and expla
	some basic methods from mathematical Finance	iooo, oop. iii olaaliono anaoi ma	mapro objectivos and	anconanty, and oxpin
	state basics from accounting and costing and selected controlling	methods.		
Skills	Students are able to analyse business units with respect to differ Entrepreneurship project in a team. In particular, they are able to	ent criteria (organization, object	ctives, strategies etc) and to carry out
	analyse Management goals and structure them appropriately			
	analyse organisational and staff structures of companies apply methods for decision making under multiple objectives, and	ar uncertainty and under rick		
	 apply methods for decision making under multiple objectives, und analyse production and procurement systems and Business inforr 			
	analyse and apply basic methods of marketing	nation dystoms		
	select and apply basic methods from mathematical finance to pred	defined problems		
	apply basic methods from accounting, costing and controlling to p	redefined problems		
Personal Competence				
Social Competence	Students are able to			
,				
	work successfully in a team of students			
	to apply their knowledge from the lecture to an entrepreneurship p to communicate appropriately and	project and write a conerent repor	t on the project	
	to confirm factor 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				
Examination duration and scale	90 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisation Electrica	al Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Comput			
	General Engineering Science (German program): Specialisation Process	Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Bioproc	ess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Energy	and Enviromental Engineering: C	ompulsory	
	General Engineering Science (German program): Specialisation Civil- an		mpulsory	
	General Engineering Science (German program): Specialisation Mechan			
	General Engineering Science (German program): Specialisation Biomed General Engineering Science (German program): Specialisation Naval A			
	General Engineering Science (German program, 7 semester): Specialisation Navar A		pulsory	
	General Engineering Science (German program, 7 semester): Specialisa			
	General Engineering Science (German program, 7 semester): Specialisa		•	
	General Engineering Science (German program, 7 semester): Specialisa			
	General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Compuls	ory	
	General Engineering Science (German program, 7 semester): Specialisa	tion Bioprocess Engineering: Cor	mpulsory	
	General Engineering Science (German program, 7 semester): Specialisa	tion Civil Engineering: Compulso	ry	
	General Engineering Science (German program, 7 semester): Specialisa			
	General Engineering Science (German program, 7 semester): Specialisa			
	General Engineering Science (German program, 7 semester): Specialisa	-		
	General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specia	-	•	
	Compulsory	шэанын меспанкак Engineerin	y, i ocus iviateriais In	Lingingering Science
	General Engineering Science (German program, 7 semester): Special	isation Mechanical Engineering	. Focus Theoretical M	Mechanical Engineeri
	1	99		



Compulsory

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

ompulsory

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

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory

Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

 $\label{thm:condition} \textbf{General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory and Computation Civil- and Civil- and$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

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

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

Technomathematics: Core qualification: Compulsory



Course L0880: Introduction to Mana	gement	
Тур	Lecture	
Hrs/wk	3	
CP	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgang	
Lecturer	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona	
Language	DE	
Cycle	WiSe/SoSe	
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management, Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing 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
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 Typ Hrs/wk CP Introduction into Medical Technology and Systems (L0342) Introduction into Medical Technology and Systems (L0343) Module Responsible Prof. Alexander Schlaefer Admission Requirements none Recommended Previous Knowledge principles of math (algebra, analysis/calculus) principles of stochastics principles of programming, R/Matlab Educational Objectives After taking part successfully, students have reached the following learning results The students are able to apply principles of medical technology to solving actual problems.
Title Introduction into Medical Technology and Systems (L0342) Introduction into Medical Technology and Systems (L0343) Introduction into Medical Technology and Systems (L0343) Module Responsible Prof. Alexander Schlaefer Recommended Previous Knowledge principles of math (algebra, analysis/calculus) principles of stochastics principles of programming, R/Matlab Educational Objectives After taking part successfully, students have reached the following learning results The students can explain medical technology and its principles, including imaging systems, computer aided surgery, medical sensor systems, medical technology.
Title Introduction into Medical Technology and Systems (L0342) Introduction into Medical Technology and Systems (L0343) Introduction into Medical Technology and Systems (L0343) Module Responsible Prof. Alexander Schlaefer Recommended Previous Knowledge principles of math (algebra, analysis/calculus) principles of stochastics principles of programming, R/Matlab Educational Objectives After taking part successfully, students have reached the following learning results The students can explain medical technology and its principles, including imaging systems, computer aided surgery, medical sensor systems, medical technology.
Introduction into Medical Technology and Systems (L0342) Introduction into Medical Technology and Systems (L0343) Module Responsible Prof. Alexander Schlaefer
Introduction into Medical Technology and Systems (L0343) Module Responsible Admission Requirements none Recommended Previous Knowledge principles of math (algebra, analysis/calculus) principles of programming, R/Matlab Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge Knowledge The students can explain medical technology and its principles, including imaging systems, computer aided surgery, medical sensor systems, medical technology.
Module Responsible
Admission Requirements none Recommended Previous Knowledge principles of math (algebra, analysis/calculus) principles of stochastics principles of programming, R/Matlab Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge The students can explain medical technology and its principles, including imaging systems, computer aided surgery, medical sensor systems, minormation systems. They are able to give an overview of regulatory affairs and standards in medical technology.
Recommended Previous Knowledge Principles of math (algebra, analysis/calculus) principles of stochastics principles of programming, R/Matlab Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge The students can explain medical technology and its principles, including imaging systems, computer aided surgery, medical sensor systems, medical technology.
Knowledge principles of stochastics principles of programming, R/Matlab Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge The students can explain medical technology and its principles, including imaging systems, computer aided surgery, medical sensor systems, minormation systems. They are able to give an overview of regulatory affairs and standards in medical technology.
principles of programming, R/Matlab Educational Objectives
Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge The students can explain medical technology and its principles, including imaging systems, computer aided surgery, medical sensor systems, minormation systems. They are able to give an overview of regulatory affairs and standards in medical technology.
Professional Competence Knowledge The students can explain medical technology and its principles, including imaging systems, computer aided surgery, medical sensor systems, minformation systems. They are able to give an overview of regulatory affairs and standards in medical technology.
Knowledge The students can explain medical technology and its principles, including imaging systems, computer aided surgery, medical sensor systems, minformation systems. They are able to give an overview of regulatory affairs and standards in medical technology.
information systems. They are able to give an overview of regulatory affairs and standards in medical technology.
Skills The students are able to apply principles of medical technology to solving actual problems.
The students are able to apply principles of medical technology to solving actual problems.
Personal Competence
Social Competence The students describe a problem in medical technology as a project, and define tasks that are solved in a joint effort.
Autonomy The students can reflect their knowledge and document the results of their work. They can present the results 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 Biomedical Engineering: Compulsory
Curricula General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Computer Science: Specialisation Computer and Software Engineering: Elective Compulsory
Electrical Engineering: Core qualification: Elective Compulsory
General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Computational Science and Engineering: Specialisation Engineering Sciences: Elective Compulsory
Computational Science and Engineering: Specialisation Computer Science: Elective Compulsory
Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory
Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory
Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory
Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory
Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course 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



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ourses				
le		Тур	Hrs/wk	CP
roduction 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 le	arning results		
Professional Competence				
Knowledge				
Ü	The students can			
	 describe the basics of the energy metabolism; 			
	 describe physiological connections in select fields of muscle 	heart/circulation, neuro- and se	nsory physiology.	
Skills				
	The students can			
	 describe the effects of basic bodily functions (sensory, transit 	nission and processing of inform	ation, development of forces	s and vital functions) a
	relate them to similar technical systems.			
Personal Competence				
Social Competence				
	The students can conduct discussions in research and medicine on	a technical level.		
	The students can find solutions to problems in the field of physiology	, both analytical and metrologica	al	
Autonomy	The students can develop understanding of topics from the course,	ising technical literature, by them	nselves	
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 Me	chanical Engineering, Focus Ric	mechanics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Bio			
041110414	General Engineering Science (German program, 7 semester): Spec			
	General Engineering Science (German program, 7 semester): Spec	-		mpulsory
	Electrical Engineering: Specialisation Medical Technology: Elective		<u> </u>	, ,
	General Engineering Science (English program): Specialisation Me		mechanics: Compulsory	
	General Engineering Science (English program): Specialisation Bio			
	General Engineering Science (English program, 7 semester): Speci			npulsory
	General Engineering Science (English program, 7 semester): Speci	alisation Biomedical Engineering	g: Compulsory	
	Mechanical Engineering: Specialisation Biomechanics: Compulsory			
	Biomedical Engineering: Specialisation Medical Technology and Co	ntrol Theory: Elective Compulso	ory	
	Biomedical Engineering: Specialisation Management and Business	Administration: Elective Compul	sory	
	Biomedical Engineering: Specialisation Artificial Organs and Regen	erative Medicine: Elective Comp	ulsory	
	Biomedical Engineering: Specialisation Implants and Endoprosthes	es: Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Elective	e 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



Specialization Naval Architecture

The Bachelor Course "Naval Architecture" prepares by the elective modules for scientific tasks in naval architecture, ocean engineering and related mechanical engineering disciplines. Thus, the occupational orientation can either related to the design of ships or offshore systems, or to more dedicated areas, such as hydrodynamics or strength of structures.

urses			
)	Тур	Hrs/wk	CP
eduction to Control Systems (L0654)	Lecture	2	4
duction 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		.:	. E
	Students can represent dynamic system behavior in time and frequency domain, and can in particular explain the system behavior in time and frequency domain, and can in particular explain the system behavior in time and frequency domain.	ain properties o	filrst and second (
	systems		
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequence. They can explain the Maria to th	cy response and	d root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it. They can explain the Nyquist stability criterion and the stability margins derived from it. They can explain the Nyquist stability criterion and the stability margins derived from it. They can explain the Nyquist stability criterion and the stability margins derived from it.		
	They can explain the role of the phase margin in analysis and synthesis of control loops They can explain the role of the phase margin in analysis and synthesis of control loops They can explain the role of the phase margin in analysis and synthesis of control loops.		
	They can explain the way a PID controller affects a control loop in terms of its frequency response		
	They can explain issues arising when controllers designed in continuous time domain are implemented digit	itally	
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 te	echniques	
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for dig	gital implement	ation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks		
Personal Competence			
Social Competence			
Autonomy	LStudente can obtain information from provided courses (lecture notes, coffware decumentation, experiment qui		
		ides) and use	it when solving (
,	problems.	ides) and use	it when solving (
	problems.	ides) and use	it when solving (
		ides) and use	it when solving (
	problems.	ides) and use	it when solving (
,	problems.	ides) and use	it when solving (
,	problems.	ides) and use	it when solving (
Workload in Hours	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress.	ides) and use	it when solving (
	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56	ides) and use	it when solving (
Workload in Hours	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56	ides) and use	it when solving (
Workload in Hours Credit points	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam	ides) and use	it when solving (
Workload in Hours Credit points Examination	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min	ides) and use	it when solving (
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory	ides) and use	it when solving (
Workload in Hours Credit points Examination Examination duration and scale	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory		it when solving (
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory		it when solving (
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory		it when solving (
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 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		it when solving (
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 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		it when solving (
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 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		it when solving (
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering:		it when solving (
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	problems. They can assess their knowledge in weekly on-line tests and thereby control their learning progress. Independent Study Time 124, Study Time in Lecture 56 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory	g: Compulsory	
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General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

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

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

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

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

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

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

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

 $General\ Engineering\ Science\ (English\ program,\ 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Aircraft\ Systems\ Engineering:\ Compulsory\ Specialisation\ Mechanical\ Engineering:\ Compulsory\ Mechanical\ Engineering:\ Mech$ General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory



Course L0654: Introduction to Contr	rol Systems
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	Signals and systems
	Linear systems, differential equations and transfer functions
	First and second order systems, poles and zeros, impulse and step response
	Stability
	Feedback systems
	Principle of feedback, open-loop versus closed-loop control
	Reference tracking and disturbance rejection
	Types of feedback, PID control
	System type and steady-state error, error constants
	Internal model principle
	Root locus techniques
	Root locus plots
	Root locus design of PID controllers
	Frequency response techniques
	Bode diagram
	Minimum and non-minimum phase systems
	Nyquist plot, Nyquist stability criterion, phase and gain margin
	Loop shaping, lead lag compensation
	Frequency response interpretation of PID control
	Time delay systems
	Root locus and frequency response of time delay systems
	Smith predictor
	Digital control
	a Complete data sustama differenza aquationa
	Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers
	Software tools
	Introduction to Matlab, Simulink, Control toolbox
	Computer-based exercises throughout the course
Literature	 Werner, H., Lecture Notes "Introduction to Control Systems" G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010

Course L0655: Introduction to Control Systems	
Тур	Recitation Section (small)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Herbert Werner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses		
itle (1999)	Typ Hrs/wk CP	
Computer Engineering (L0321) Computer Engineering (L0324)	Lecture 3 4 Recitation Section (small) 1 2	
Module Responsible		
Admission Requirements		
Recommended Previous		
Knowledge		
	The successful completion of the labs will be honored during the evaluation of the module's examination according to the following rules:	
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the successful labs, so	uch that th
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.	
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge		ing down
	gates. The module includes the following topics:	3
	• Introduction	
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks	
	 Sequential logic: Flip-flops, automata, systematic hardware design Technological foundations 	
	Computer arithmetic: Integer addition, subtraction, multiplication and division	
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining	
	Memories: Memory hierarchies, SRAM, DRAM, caches	
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses	
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the physical cor	
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a collection of few	
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing systems - from gates	and circi
	up to complete processors.	
	After successful completion of the module, the students are able to judge the interdependencies between a physical computer system and	the softwa
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-centric abstraction	layers fr
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels have on an en	tire syste
	performance and to propose feasible options.	
	portunitation and to propose readilities opening.	
Personal Competence		
Personal Competence Social Competence		
Personal Competence Social Competence		
	Students are able to solve similar problems alone or in a group and to present the results accordingly.	
Social Competence	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.	
Social Competence Autonomy	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56	
Social Competence Autonomy Workload in Hours Credit points	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56	
Social Competence Autonomy Workload in Hours Credit points Examination	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs	
Social Competence Autonomy Workload in Hours Credit points Examination	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Students are able to solve similar problems alone or in a group and to present the results accordingly. Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes. Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory	
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Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
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General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Computational Science and Engineering: Core qualification: Compulsory
Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineering	ng
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	Introduction Combinational Logic Sequential Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005.

Тур	Recitation Section (small)
Hrs/wk	1
СР	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	1. Introduction
	Production of the first of the
	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
	- Directly profitod
	3. Digital Circuits
	Logic signals and gates
	Logic families
	CMOS logic
	CMOS circuits: electrical behavior
	ONIOS CIrcuits, electrical pellavior



- 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 shifte
- 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
- 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



ourses				
tle		Тур	Hrs/wk	СР
roduction to Management (L0880) oject Entrepreneurship (L0882)		Lecture Problem-based Learning	3 2	3
Module Responsible	Prof. Christoph Ihl	1 Tobiem-based Learning		3
Admission Requirements	`			
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of Marketing and Innovation, and also to Investment and Controllin		nagement, from Planr	ning and Organisation
	explain the differences between Economics and Manage field of Management explain the most important aspects of and goals in Mana describe and explain basic business functions as produces management, information management, innoves explain the relevance of planning and decision making	gement and name the most important aspect action, procurement and sourcing, supply of ration management and marketing	cts of entreprneurial p	orojects organization and hum
	some basic methods from mathematical Finance state basics from accounting and costing and selected or		., ,	, , , , , , , , , , , , , , , , , , ,
Skills	Students are able to analyse business units with respect Entrepreneurship project in a team. In particular, they are able to		tives, strategies etc.) and to carry out
	analyse Management goals and structure them appropri analyse organisational and staff structures of companies	•		
	apply methods for decision making under multiple object			
	analyse production and procurement systems and Busin			
	analyse and apply basic methods of marketing			
	select and apply basic methods from mathematical finan			
	apply basic methods from accounting, costing and control	oning 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 entrepren	eurship project and write a coherent report	on the project	
	to communicate appropriately and 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			
Workload III Floars				
Credit points				
Credit points Examination	Written exam			
•				
Examination	90 Minuten	n Electrical Engineering: Compulsory		
Examination Examination duration and scale	90 Minuten General Engineering Science (German program): Specialisation			
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation	n Computer Science: Compulsory n Process Engineering: Compulsory		
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory		
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Co	, ,	
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Co n Civil- and Enviromental Engeneering: Con	, ,	
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory	, ,	
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory	, ,	
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compu	ulsory	
Examination Examination duration and scale Assignment for the Following	90 Minuten 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	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compul	ulsory	
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compul pecialisation Process Engineering: Compul pecialisation Biomedical Engineering: Compul	ulsory sory sory pulsory	
Examination Examination duration and scale Assignment for the Following	90 Minuten 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	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compul pecialisation Process Engineering: Compul pecialisation Biomedical Engineering: Compul pecialisation Biomedical Engineering: Compul pecialisation Naval Architecture: Compulso	ulsory sory spulsory ry	
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	a Computer Science: Compulsory a Process Engineering: Compulsory a Bioprocess Engineering: Compulsory a Bioprocess Engineering: Compulsory a Energy and Enviromental Engineering: Co a Civil- and Enviromental Engeneering: Con a Mechanical Engineering: Compulsory a Biomedical Engineering: Compulsory b Naval Architecture: Compulsory pecialisation Electrical Engineering: Compul pecialisation Process Engineering: Compul pecialisation Biomedical Engineering: Compul pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso	ulsory lsory pulsory ry	
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compul pecialisation Process Engineering: Compul pecialisation Biomedical Engineering: Compul pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Compulso pecialisation Bioprocess Engineering: Compulso	ulsory lsory lsory ipulsory ry iry	
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compul pecialisation Process Engineering: Compul pecialisation Biomedical Engineering: Compul pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Bioprocess Engineering: Com pecialisation Bioprocess Engineering: Com pecialisation Civil Engineering: Compulsor pecialisation Energy and Enviromental Eng	ulsory lsory lsory ipulsory ry iry ipulsory y	
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compul pecialisation Process Engineering: Compul pecialisation Biomedical Engineering: Compul pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Bioprocess Engineering: Com pecialisation Civil Engineering: Compulso pecialisation Civil Engineering: Compulso pecialisation Energy and Enviromental Eng pecialisation Mechanical Engineering, Foca	ulsory lsory lsory pulsory ry pury ipulsory y ineering: Compulsor us Mechatronics: Cor	npulsory
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Science Ingineering Science (Ger	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compul pecialisation Process Engineering: Compul pecialisation Biomedical Engineering: Compul pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Bioprocess Engineering: Com pecialisation Civil Engineering: Compulso pecialisation Mechanical Engineering, Focu pecialisation Mechanical Engineering, Focu	ulsory lsory lsory lpulsory ry lpulsory y lpulsory y ineering: Compulsor us Mechatronics: Cor us Biomechanics: Co	npulsory mpulsory
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): S	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compul pecialisation Process Engineering: Compul pecialisation Biomedical Engineering: Compul pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Civil Engineering: Compulso pecialisation Civil Engineering: Compulso pecialisation Mechanical Engineering, Focu pecialisation Mechanical Engineering, Focu pecialisation Mechanical Engineering, Focu pecialisation Mechanical Engineering, Focu	ulsory disory disory dispulsory d	npulsory mpulsory ngineering: Compulso
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester): Science Ingineering Science (Ger	n Computer Science: Compulsory n Process Engineering: Compulsory n Bioprocess Engineering: Compulsory n Energy and Enviromental Engineering: Con n Civil- and Enviromental Engeneering: Con n Mechanical Engineering: Compulsory n Biomedical Engineering: Compulsory n Naval Architecture: Compulsory pecialisation Electrical Engineering: Compul pecialisation Process Engineering: Compul pecialisation Biomedical Engineering: Compul pecialisation Naval Architecture: Compulso pecialisation Computer Science: Compulso pecialisation Bioprocess Engineering: Com pecialisation Civil Engineering: Compulso pecialisation Civil Engineering: Compulso pecialisation Mechanical Engineering, Focu pecialisation Mechanical Engineering, Focu pecialisation Mechanical Engineering, Focu pecialisation Mechanical Engineering, Focu	ulsory disory disory dispulsory d	npulsory mpulsory ngineering: Compulso



Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

ompulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

 $\label{thm:condition} \textbf{General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory and the second seco$

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program); Specialisation Energy and Environmental Engineering; Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Compulsory\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Mechanical\ Engineering,\ M$

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 $\label{thm:compulsory} \textbf{Mechanical Engineering: Core qualification: Compulsory}$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory



Tun	Lecture
Typ	3
Hrs/wk	
	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfga
Lammina	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona DE
Language	WiSe/SoSe
Cycle	WI26/2026
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
	Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008.

Course L0882: Project Entrepreneurship		
Тур	Problem-based Learning	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Christoph Ihl	
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.	



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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)		
	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		
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	Main features of complex analysis	
	Functions of one complex variable Complex differentiation Conformal mappings Complex integration Cauchy's integral theorem Cauchy's integral formula Taylor and Laurent series expansion Singularities and residuals Integral transformations: Fourier and Laplace transformation	
Literature	http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html	



Course L1041: Complex Functions		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1042: Complex Functions		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0960: Mechanics	IV (Kinetics II, Oscillations, Analytical Mecha	nics Multibody Systems)		
module mosos. meenames	iv (Kinetios II, Osomations, Analytical Meenia	mos, manuscay Gystems,		
courses				
tle		Тур	Hrs/wk	CP
echanics IV (Kinetics II, Oscillations, Ana	alytical Mechanics, Multibody Systems) (L1137)	Lecture	3	3
Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) (L1138)		Recitation Section (small)	2	2
	alytical Mechanics, Multibody Systems) (L1139)	Recitation Section (large)	1	1
Module Responsible	Prof. Robert Seifried			
Admission Requirements	none			
Recommended Previous	Mathematics I-III and Mechanics I-III			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	wing learning results		
Professional Competence				
Knowledge	The students can			
	a describe the evicentic precedure used in mechanics	Looptoyto		
	describe the axiomatic procedure used in mechanica available important stops in model design:	Contexts,		
	explain important steps in model design; present technical knowledge.			
	 present technical knowledge. 			
Skills	The students can			
	explain the important elements of mathematical / med	hanical analysis and model formation, and app	bly it to the context of	their own problems;
	 apply basic methods to engineering problems; 	de la contra de la contra la contra de la contra dela contra de la contra dela contra de la contra del la contra		
	 estimate the reach and boundaries of the methods are 	d extend them to be applicable to wider proble	m sets.	
Personal Competence				
Social Competence	The students can work in groups and support each other to o	vercome difficulties.		
Autonomy	Students are capable of determining their own strengths and	weaknesses and to organize their time and lea	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): Specialisa	tion Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisa	tion Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisa	tion Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Com	pulsory	
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulso	ry	
	General Engineering Science (English program): Specialisa	ion Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisa	ion Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisa	ion Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 semester)	: Specialisation Mechanical Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester)	: Specialisation Biomedical Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester)	: Specialisation Naval Architecture: Compulsor	у	
	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 Compulsor	1		
	Theoretical Mechanical Engineering: Technical Complemen	tary Course Core Studies: Elective Compulsory	1	

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 (Kineti	ourse L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)	
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0680: Fluid Dynar	nics			
0				
Courses				
Title		Тур	Hrs/wk	СР
Fluid Mechanics (L0454) Fluid Mechanics (L0455)		Lecture Recitation Section (large)	3 2	4
Module Responsible	Prof. Thomas Rung	rectation dection (large)	2	2
Admission Requirements	•			
	none	agains and thormodynamics		
Recommended Previous Knowledge	Sound knowledge of engineering mathematics, engineering med	ianics and mermodynamics.		
0	After taking part auguspafully, at idente have reached the following	Learning regulte		
Educational Objectives	After taking part successfully, students have reached the following	rearring results		
Professional Competence	Or death will be a state of a second base of a second base of	and the state of t	and an Investment of Martinland	New Janets and the Property of
Knowledge	Students will have the required sound knowledge to explain the			•
	outline the rationale of flow physics using mathematical models	and are familiar with methods for the pe	errormance analysis a	ina the prediction of fluid
	engineering devices.			
Skills	Students are able to apply fluid-engineering principles and flow-p	physics models for the analysis of technic	al systems. The lectu	re enables the student to
	carry out all necessary theoretical calculations for the fluid dynam	ic design of engineering devices on a sci	entific level.	
Personal Competence				
Social Competence	The students are able to discuss problems and jointly develop sol	ution strategies.		
Autonomy	The students are able to develop solution strategies for complex p	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): Specialisation	Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	Biomedical Engineering: Compulsory		
	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	·	ory	
	General Engineering Science (English program): Specialisation M			
	General Engineering Science (English program): Specialisation E			
	General Engineering Science (English program): Specialisation N			
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe		ory	
	Computational Science and Engineering: Specialisation Enginee	ring Sciences: Elective Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory	stive Compulsory		
	Technomathematics: Specialisation III. Engineering Science: Elec	cuve Compulsory		

Course L0454: Fluid Mechanics		
Тур	Lecture	
Hrs/wk	3	
CP	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Thomas Rung	
Language	DE	
Cycle	SoSe	
Content	 Overview Physical/mathematical modelling Special phenomena Basic equations of fluid dynamics The turbulence problem One dimensional theory for inkompressibel flows One dimensional theory for kompressibel flows Flow over contours without friction Flow over contours with friction Flow through channels Simplified equations for three dimensional flow Special aspects of the numerical solution for complex flows 	
Literature	 Herwig, H.: Strömungsmechanik, 2. Auflage, Springer- Verlag, Berlin, Heidelberg, 2006 Herwig, H.: Strömungsmechanik von A-Z, Vieweg Verlag, Wiesbaden, 2004 	



Course L0455: Fluid Mechanics	
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Thomas Rung
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0640: Stochastics	s and Ship Dynamics			
	, , , , , , , , , , , , , , , , , , ,			
Courses				
Title		Тур	Hrs/wk	CP
Ship Dynamics (L0352)		Lecture	2	3
Ship Dynamics (L1620)	14 17 10 5 1 1 (1994)	Recitation Section (small)	1	1
	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 followin	a learning results		
Professional Competence	Arter taking part successitility, stations mave reaction the following	g learning results		
Knowledge	- The students are able to give an overview over various mano	euvres. They can name application goa	Is and they can desc	ribe the procedure of th
, in a modge	manoeuvres.	ourroo. may our name approarion god	io and moy can door	indo and procedure or an
	- The students are able to give an overview over varius rudder type	bes. They can name criteria in the rudder	design.	
	- 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 maneguares. The ca	n use and linearise th	om.
Okliis	The students can come up with the equations of motions which	are used to discribe manoedvies. The ca	ii use and iiileanse iii	5111.
	- The students are able to determine hydrodynamic coefficients a	nd they can explain their physical meaning	ng.	
	- The students can explain how a rudder works and they can exp	ain the physical effects which can occur.		
	- The students can mathematically describe waves.			
	- The students can explain the mathematically description of harr	noncial motions in waves and they can de	etermine them.	
Personal Competence				
Social Competence	- The students can arrive at work results in groups and document	them.		
	- The students can discuss in groups and explain their point of vie	ew.		
Autonomy Warkland in Hause	- The students can assess their own strengthes and weaknesses	and the define further work steps on this	basis.	
Workload in Hours	Independent Study Time 140, Study Time in Lecture 70			
Credit points	,			
Examination	Written exam			
Examination duration and scale	180 min	New J. A. arki'a at a second and a second and		
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program, 7 semester): Sp		sory	
	General Engineering Science (English program): Specialisation		on.	
	General Engineering Science (English program, 7 semester): Sp Naval Architecture: Core qualification: Compulsory	eciansation ivavai Alchitecture: Compulsi	UTY	
	rvavar Architecture. Core quantication, Compulsory			



Course L0352: Ship Dynamics	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Moustafa Abdel-Maksoud
Language	DE
Cycle	SoSe
Content	Maneuverability of ships
	Equations of motion Hydrodynamic forces and moments Linear equations and their solutions Full-scale trials for evaluating the maneuvering performance Regulations for maneuverability Rudder Seakeeping Representation of harmonic processes Motions of a rigid ship in regular waves Flow forces on ship cross sections Strip method Consequences induced by ship motion in regular waves
Literature	Behavior of ships in a stationary sea state Long-term distribution of seaway influences
	 Abdel-Maksoud, M., Schiffsdynamik, Vorlesungsskript, Institut für Fluiddynamik und Schiffstheorie, Technische Universität Hamburg-Harburg 2014 Abdel-Maksoud, M., Ship Dynamics, Lecture notes, Institute for Fluid Dynamic and Ship Theory, Hamburg University of Technology, 2014 Bertram, V., Practical Ship Design Hydrodynamics, Butterworth-Heinemann, Linacre House - Jordan Hill, Oxford, United Kingdom, 2000 Bhattacharyya, R., Dynamics of Marine Vehicles, John Wiley & Sons, Canada, 1978 Brix, J. (ed.), Manoeuvring Technical Manual, Seehafen-Verlag, Hamburg, 1993 Claus, G., Lehmann, E., Östergaard, C). Offshore Structures, I-II, Springer-Verlag. Berlin Heidelberg, Deutschland, 1992 Faltinsen, O. M., Sea Loads on Ships and Offshore Structures, Cambridge University Press, United Kingdom, 1990 Handbuch der Werften, Deutschland, 1986 Jensen, J. J., Load and Global Response of Ships, Elsevier Science, Oxford, United Kingdom, 2001 Lewis, Edward V. (ed.), Principles of Naval Architecture - Motion in Waves and Controllability, Society of Naval Architects and Marine Engineers Jersey City, NJ, 1989 Lewandowski, E. M., The Dynamics of Marine Craft: Maneuvering and Seakeeping, World Scientific, USA, 2004 Lloyd, A., Ship Behaviour in Rough Weather, Gosport, Chichester, Sussex, United Kingdom, 1998

Course L1620: Ship Dynamics	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Moustafa Abdel-Maksoud
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L0364: Statistics and 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, 3 rd Edition, John Wiley & Sons, Inc., New York, NY, 2009 ITTC Recommended Procedures and Guidelines, In: Quality Systems Manual, International Towing Tank Conference (ITTC), 2011 F.M. Dekking, C. Kraaikamp, H.P. Lopuhaä, L.E. Meester, A Modern Introduction To Probability and Statistics, Springer, 2005 Springer Handbook of Engineering Statistics, H. Pham (Hrsg.), Springer, 2006 A. Klenke, Wahrscheinlichkeitstheorie, Springer, 2013



Module M0655: Computation	onal Fluid Dynamics I			
-				
Courses				
Title		Тур	Hrs/wk	CP
Computational Fluid Dynamics I (L0235) Computational Fluid Dynamics I (L0419)		Lecture Recitation Section (large)	2	3
Module Responsible	Prof. Thomas Rung	riecitation dection (large)	2	3
Admission Requirements	None			
Recommended Previous	TVOTTE			
Knowledge	 Mathematical Methods for Engineers 			
ougo	 Fundamentals of Differential/integral calculus and series exp 	ansions		
Educational Objectives	After taking part successfully, students have reached the following le	parning results		
Professional Competence	The same part occoording, account have reached the following to	ag roomb		
Knowledge	The students are able to list the basic numerics of partial differential	equations.		
·····		- 4		
Skills	The students are able develop appropriate numerical integration	in space and time for the governing	partial differential ed	quations. They can code
	computational algorithms in a structured way.		•	
B				
Personal Competence				
Social Competence	The students can arrive at work results in groups and document then	n.		
Autonomy	The students can independently analyse approaches to colving and	oifia probleme		
Autonomy	The students can independently analyse approaches to solving spe	chic problems.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	2h			
Assignment for the Following	General Engineering Science (German program): Specialisation Me	chanical Engineering, Focus Energy S	Systems: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Na			
	General Engineering Science (German program, 7 semester): Spec			
	General Engineering Science (German program, 7 semester): Spec		cus Energy Systems: I	Elective Compulsory
	General Engineering Science (English program): Specialisation Na		0	
	General Engineering Science (English program): Specialisation Me			
	General Engineering Science (English program, 7 semester): Speci General Engineering Science (English program, 7 semester): Speci	·	•	lective Compulsory
	Naval Architecture: Core qualification: Compulsory	ansauon weonamoai Engineeniig, Foc	us Ellergy Systems: E	iective Compulsory
	Technomathematics: Specialisation III. Engineering Science: Electiv	e Compulsory		
	Technomathematics: Specialisation III. Engineering Science: Electiv			

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 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



wodule wooss: Fulldamen	tals of Ship Structural Design and Analy	313		
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Ship Structural Design (L	LO411)	Lecture	2	2
Fundamentals of Ship Structural Design (L	_0413)	Recitation Section (small)	1	2
Fundamentals of Ship Structural Analysis	(L0410)	Lecture	2	2
Fundamentals of Ship Structural Analysis	(L0414)	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 t	ne following learning regulte		
•	Alter taking part successionly, students have reached to	le following featiling festilis		
Professional Competence				
Knowledge	Students can reproduce the basic contents of the structural behaviour of ship structures; they can explain the theory and methods for the calcula			
	deformations and stresses in beam-like structures.			
	Furthermore, they can reproduce the basis contents of codes (rules), materials, semi-finished products, joining and principles of structural			es of structural design
	components in the ship structure.			
	components in the ship structure.			
Skills	Students are capable of applying the methods and tools for the calculation of linear deformations and stresses in the above mentioned structures			
	can choose calculation models of typical ship structure	PS.		
	Furthermore, they are capable to apply the methods of drawing and sizing the ship structure; they can select suitable materials, semi-finished productions are capable to apply the methods of drawing and sizing the ship structure; they can select suitable materials, semi-finished prod			
	and joints.			
Personal Competence				
Social Competence	The students are able to communicate and cooperate in a professional environment in the shipbuilding and component supply industry.			
A	The ctudents are conclude to independently idealize real chin structures and to colort suitable methods for analysis of beam like structures they a			
Autonomy	The students are capable to independently idealize real ship structures and to select suitable methods for analysis of beam-like structures; the			
	capable to assess the results of structural analyses.			
	Furthermore, they are capable to assess drawings of complex ship structures and to design ship structures for various requirements and bound conditions.			
Workload in Hours	Independent Study Time 156, Study Time in Lecture 8	4		
	Written exam			
Examination				
Examination duration and scale	3 hours	similar tion Novel Architecture Commute		
Assignment for the Following	General Engineering Science (German program): Spe	' '		
Curricula	Curricula General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory			
	General Engineering Science (English program): Specialisation Naval Architecture: Compulsory			
	General Engineering Science (English program, 7 ser	nester): Specialisation Naval Architecture: Compulso	ry	
	Naval Architecture: Core qualification: Compulsory			



Course L0411: Fundamentals of Ship Structural Design				
Тур	Lecture			
Hrs/wk	2			
СР	2			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28			
Lecturer	Prof. Sören Ehlers			
Language	DE			
Cycle	WiSe			
Content	Chapters:			
	1. Introduction			
	3. Class societies and their tasks			
	4. Materials for steel shipbuilding			
	5. Welding and Cutting			
	6. Semi-finished products in steel shipbuilding			
	7. Determining the scantlings for local loads			
	8. Longitudinal strength of the hull girder			
	Determining the scantlings of longitudinal structural members			
	10. Determining the scantlings of bottom and side structures			
	11. Decks and Hatch Openings			
	12. Effective breadth			
	13. Iterative determination of scantlings (POSEIDON)			
Literature	Vorlesungsskript mit weiteren Literaturangaben wird über das Internet verfügbar gemacht			

Course L0413: Fundamentals of Shi	Course L0413: Fundamentals of Ship Structural Design		
Тур	Recitation Section (small)		
Hrs/wk	1		
СР	2		
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14		
Lecturer	Prof. Sören Ehlers		
Language	DE		
Cycle	WiSe		
Content	Chapters:		
	1. Introduction		
	3. Class societies and their tasks		
	4. Materials for steel shipbuilding		
	5. Welding and Cutting		
	6. Semi-finished products in steel shipbuilding		
	7. Determining the scantlings for local loads		
	8. Longitudinal strength of the hull girder		
	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	



Module M0664: Structural I	Design and Construction of Ships			
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 reached the follow	wing learning results		
Professional Competence				
Knowledge	Students can reproduce design and sizing as well as fabrica they can describe calculation models for complex structures.	ation of the different areas of ship structures	and of different ship t	ypes (incl. detail design)
Skills	Students are capable to specify the requirements for different suitable calculation models and to assess the chosen structure		ne design criteria for tl	ne components, to selec
Personal Competence				
Social Competence	Students are capable to present their structural design and dis	scuss their decisions constructively in a grou	ıp.	
Autonomy	Students are capable to design independently different structure methods.	ctural areas of the ship hull and different s	hip types and to defin	e appropriate fabrication
Workload in Hours	Independent Study Time 172, Study Time in Lecture 98			
Credit points	9			
Examination	Written exam			
Examination duration and scale	3 hours			
Assignment for the Following	General Engineering Science (German program): Specialisat	tion Naval Architecture: Compulsory		
Curricula	General Engineering Science (German program, 7 semester)		sorv	
Janioala	General Engineering Science (English program): Specialisati	·	,	
	General Engineering Science (English program, 7 semester):		sory	
	Naval Architecture: Core qualification: Compulsory	,	•	



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:	
	1. Bulkheads and tanks 2. Structural design of forebodies 3. Structures in engine rooms 4. Aft bodies and rudders 5. Detail structural design 6. Outfiting 7. Bulk carriers 8. Tankers 9. Container ships 10. Production-kind steel structural design 11. Buckling and ultimate strength 12. Safety factors and reliability of structures	
Literature	Vorlesungsskript mit weiteren Literaturangaben wird über das Internet verfügbar gemacht	

Course L0415: Ship Structural Design	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:		
	1. Bulkheads and tanks 2. Structural design of forebodies 3. Structures in engine rooms 4. Aft bodies and rudders 5. Detail structural design 6. Outfitting 7. Bulk carriers 8. Tankers 9. Container ships 10. Production-kind steel structural design 11. Buckling and ultimate strength 12. Safety factors and reliability of structures		
Literature	Vorlesungsskript mit weiteren Literaturangaben wird über das Internet verfügbar gemacht		



Course L1123: Welding Technology				
Тур	Lecture			
Hrs/wk	3			
СР	3			
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Lecturer	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.			



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	Manhanta				
Knowledge	Mechanics Third Properties for Neural Ambitraria				
	Fluid Dynamics for 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 pheno	mena and their practica	
	applications to hullform design as well as numerical and empiric	al prediction methods are subject of the	course. Furthermore,	environmental additiona	
	resistances are dealt with. The course includes model test techniques and their application to full scale ships. This hold also for propulsion and				
	hullefficiency elements, mainly thrust deduction and wake. Main Focus is how hull forms can be optimized for minimum and sustainable fuel				
	consumption. The following topics are dealt with:				
	- Stillwater/added resistance, Wave resistance, Minimization of wave resistance, numerical prediction methods, friction laws, laminar/turbulent flow				
	separation, Hull form design for redcude flow separation, Appendage Design and resistance, Froude's resistance law,form factor method, thrust				
	deduction, wake, model scaling laws, resistance tests, free running propeller tests and propeller basics, propulsion tests, full scale speed power				
	predictions, additional resistances (wind, steering, current, sea st	ate), EEDI, speed trials, contractual matte	ers concerning speed/p	ower, bunker claims	
Skills	The student shall learn to design competitve hull forms with resp	ect to fuel consumption by applying nu	mreical techniques and	to evaluate these hulls	
C.i.iic	by several progosis methods. Furtermore, the course will e		·		
	environmental influences.		4114 1111111120 1110 110	quilou potroi moluum	
Personal Competence					
Social Competence	The student learns to prepare technical matters in such a way that	t he can compte with his building suverv	ision team.		
Autonomy	The student learns to prepare technical matters in such a way that	t he can compte with his building suverv	ision team.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56				
Credit points	6				
Examination	Written exam				
Examination duration and scale	180 min				
Assignment for the Following	General Engineering Science (German program): Specialisation	Naval Architecture: Compulsory			
Curricula	General Engineering Science (German program, 7 semester): Sp	ecialisation Naval Architecture: Compuls	sory		
	General Engineering Science (English program): Specialisation I	Naval Architecture: Compulsory			
	General Engineering Science (English program, 7 semester): Sp		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	s and Body Plan				
Courses					
Title		Тур	Hrs/wk	СР	
Hydrostatics (L1260)		Lecture	2	3	
Hydrostatics (L1261)		Recitation Section (large)	2	1	
Body Plan (L1452)		Project Seminar	2	2	
Module Responsible	Prof. Stefan Krüger				
Admission Requirements	None				
Recommended Previous	Good knowledge in Mathemathics I-III and Mechanics	I-III.			
Knowledge	It is recommended that the students are familiar with ty	pical design relevant drawings, e.g. Body Plan, GA	- Plan, Tank Plan etc.		
Educational Objectives	After taking part successfully, students have reached the	ne following learning results			
Professional Competence					
Knowledge					
G	all following lectures in the subjects shipo design and safety of ships.				
Skills	The student is able to carry out hydrostatic calculations to ensure that the ship has sufficient stability. He is able to design hull forms that are safe against				
	capsizing or sinking.				
Personal Competence					
Social Competence	The student gets access to hydrostatical problems.				
,,,,,	γ				
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): Spe	cialisation Naval Architecture: Compulsory			
Curricula	General Engineering Science (German program, 7 ser	mester): Specialisation Naval Architecture: Compul	sory		
	General Engineering Science (English program): Spec	cialisation Naval Architecture: Compulsory			
	General Engineering Science (English program, 7 sen	nester): Specialisation Naval Architecture: Compuls	sory		
	Naval Architecture: Core qualification: Compulsory				

Course L1260: Hydrostatics	
•	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Stefan Krüger
Language	DE
Cycle	SoSe
Content	Numerical Integration, Diffrentation, Interpolation Trapezoidal Rule, Simpson, Tschebyscheff, graphical Integration Methods
	- Determination of Areas, 1st and 2nd order Moments
	- Numerical Diffrentation, Spline Interpolation
	2. Buyoancy
	- Principle of Archimedes
	- 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
	[511]



- Correlation between Metacentric Height and Righting Lever at small heeling angles
- Computation of Path of Metacentric Height for Modern Hull Forms
- Correlation between Righting Lever and Path of Metacentric Height
- Hydrostatic Stiffness Matrix
- Definition of MCT
- Computation of Equilibrum Floating Conditions from Hydrostatic Tables
- Effect of Free Surfaces on Initial GM
- Roll Motions at Small Roll Angles
- 6. Stability in Waves
- Roll Motions at Large Amplitudes
- Pure Loss of Stability on the Wave Crest
- Principle of Parametric Excitation
- Principle of Direct Wave Moments
- Grim's Equivalent Wave Concept
- 6 Longitudinal Strength
- Longitudinal Mass Distribution, Shear Forces, Bending Moments
- Longitudinal Strength in Stability Booklet
- 7. Deadweight Survey and Inclining Experiment
- Deplacement Computations from Draft mark Readings
- Weights to go on /come from board
- Inclining Experiment with Heeling Moments from Weights and Heeling Tanks
- Residual Sounding Volumes
- Determination of COG from Metacentric height and from Cross Curves
- Roll Decay Test
- 8. Launching and Docking
 - Launching Plan, Arrangement of Launching Blocks
 - Rigid Body Launching: Tilting, Dumping, Equation of Techel
- Computation of Launching Event
- Bottom Pressure and Longitudinal Strength
- Linear- Elastic Effects
- Transversal Stability on Slipway and in Dock
- 9. Grounding
- Loss of Buoynacy when Grounded
- Pointwise Grounding
- Ship Grounds on Keel
- 10. Introduction into Damage Stability Problems
- Added Mass Method
- Loss of Buoyant Volume Method
- Simple Equilibrium Computations
- Intermediate Stages of Flooding (Addes Mass Method), Cross- and Downflooding
- Water Ingress Through Openings
- 11. Special Problems (optional and agreed upon)
- e.g. Heavy Lift Operations
- e.g. Jacking of Jackup Vessels
- e.g. Sinking After Water Ingress

Literature 1. Herner/Rusch: Die Theorie des Schiffes Fachbuchverlag Leipzig



2. Henschke
Schiffstechnisches Handbuch, Band 1
VEB Technik Verlag Berlin

3. Das Skript zur Vorlesung, Anwendungsbeispiele und Klausuren sind auf unserer Homepage abrufbar.

Course L1261: Hydrostatics	
Тур	Recitation Section (large)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Stefan Krüger
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1452: Body Plan	
Тур	Project Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Krüger
Language	DE
Cycle	WiSe
Content	As preparation for the lecture "Hydrostatics", the students must develop a body plan of a modern twin screw vessel (cruise liner, RoPAx- feryy, RoRo) and perform elementary volumetric computations. The body plan is to be developed from a given GA or can be designed freely. All computations shall be based on graphical integration methods. The body plan consists of: - Grid - approx. 20 sections, 5 Waterlines, 5 Buttocks - Computation Volume and centre of buoyancy for several drafts - Computation of Righting Lever curve for a given displacement based on and graphical integration for several heeling angles.
Literature	1. Herner/Rusch: Die Theorie des Schiffes Fachbuchverlag Leipzig 2. Henschke Schiffstechnisches Handbuch, Band 1 VEB Technik Verlag Berlin 3. Das Skript zur Vorlesung, Anwendungsbeispiele und Klausuren sind auf unserer Homepage abrufbar.



Module M0933: Fundament	als of Materials Science			
Courses				
ïtle		Тур	Hrs/wk	CP
Fundamentals of Materials Science I (L1085) Fundamentals of Materials Science II (Advanced Ceramic Materials, Polymers and Composites) (L0506)		Lecture	2 2	2
Physical and Chemical Basics of Materials		Lecture Lecture	2	2
	Prof. Jörg Weißmüller	Lecture	2	2
Admission Requirements	None			
Recommended Previous	Highschool-level physics, chemistry und mathematics			
Knowledge	Trigitschool-level physics, chemistry und matternatics			
Knowleage				
Educational Objectives	After taking part successfully, students have reached the followin	a loarning regulte		
	After taking part successium, students have reached the following	g learning results		
Professional Competence	The students have acquired a fundamental knowledge on a	actala caramina and nalumara	and can describe this know	dadaa aamarahansii
Knowledge	The students have acquired a fundamental knowledge on n Fundamental knowledge here means specifically the issues of a			
	mechanical properties. The students know about the key aspe			
	characterizing specific properties. They are able to trace material			
	onal action 2 mg opening properties. They are able to have material	o priorioria saon to trio arraorry	ing prijologi and onomiogi iai	vo orridano.
Skills	The students are able to trace materials phenomena back to the	underlying physical and chemical	al laws of nature. Materials pl	henomena here refer
	mechanical properties such as strength, ductility, and stiffness, or	hemical properties such as corros	sion resistance, and to phase	transformations such
	solidification, precipitation, or melting. The students can explain	the relation between processing	conditions and the materials	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			
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 Engine	ering: Compulsory	
Curricula	General Engineering Science (German program): Specialisation	Mechanical Engineering: Compul	sory	
	General Engineering Science (German program): Specialisation	Biomedical Engineering: Compul-	sory	
	General Engineering Science (German program): Specialisation	Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 semester): Sp	ecialisation Mechanical Engineer	ing: Compulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Biomedical Engineer	ing: Compulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Naval Architecture: C	ompulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Energy and Envirome	ental Engineering: Compulsor	y
	Energy and Environmental Engineering: Core qualification: Com	pulsory		
	General Engineering Science (English program): Specialisation	Energy and Enviromental Enginee	ering: Compulsory	
	General Engineering Science (English program): Specialisation	Mechanical Engineering: Compuls	sory	
	General Engineering Science (English program): Specialisation	Biomedical Engineering: Compuls	sory	
	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			
	General Engineering Science (English program, 7 semester): Sp	ecialisation Energy and Envirome	ntal Engineering: Compulsor	у
	Logistics and Mobility: Specialisation Engineering Science: Elect	ive Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Ele	ctive Compulsory		

Course L1085: Fundamentals of Ma	Course L1085: Fundamentals of Materials Science I	
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Jörg Weißmüller	
Language	DE	
Cycle	WiSe	
Content		
Literature	Vorlesungsskript	
	W.D. Callister: Materials Science and Engineering - An Introduction. 5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7	



Course L0506: Fundamentals of Ma	terials Science II (Advanced Ceramic Materials, Polymers and Composites)
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Bodo Fiedler, Prof. Gerold Schneider
Language	DE
Cycle	SoSe
Content	Chemische Bindungen und Aufbau von Festkörpern; Kristallaufbau; Werkstoffprüfung; Schweißbarkeit; Herstellung von Keramiken; Aufbau und
	Eigenschaften der Keramik; Herstellung, Aufbau und Eigenschaften von Gläsern; Polymerwerkstoffe, Makromolekularer Aufbau; Struktur und
	Eigenschaften der Polymere; Polymerverarbeitung; Verbundwerkstoffe
Literature	Vorlesungsskript
	W.D. Callister: Materials Science and Engineering -An Introduction-5th ed., John Wiley & Sons, Inc., New York, 2000, ISBN 0-471-32013-7

Course L1095: Physical and Chemic	cal Basics of Materials Science
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Müller
Language	DE
Cycle	WiSe
Content	Motivation: "Atoms in Mechanical Engineering?" Basics: Force and Energy The electromagnetic Interaction "Detour": Mathematics (complex e-funktion etc.) The atom: Bohr's model of the atom Chemical bounds The multi part problem: Solutions and strategies Descriptions of using statistical thermodynamics Elastic theory of atoms Consequences of atomar properties on makroskopic Properties: Discussion of examples (metals, semiconductors, hybrid systems)
Literature	Für den Elektromagnetismus: Bergmann-Schäfer: "Lehrbuch der Experimentalphysik", Band 2: "Elektromagnetismus", de Gruyter Für die Atomphysik: Haken, Wolf: "Atom- und Quantenphysik", Springer Für die Materialphysik und Elastizität: Hornbogen, Warlimont: "Metallkunde", Springer



Module M1110: Ship Desig				
Courses				
ïtle		Тур	Hrs/wk	СР
hip Design (L1262)		Lecture	2	3
Ship Design (L1264)		Recitation Section (large)	2	3
Module Responsible	Prof. Stefan Krüger			
Admission Requirements	None			
Recommended Previous	Fluid Dynamics for Naval Architects, Posistance and Pro	nulcion		
Knowledge	 Fluid Dynamics for Naval Architects, Resistance and Pro Resistance and Propulsion, Hydrostatics 	puision		
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	The lecture starts with an overview about the importance an	d requirements of the aerly design pha	se. Competitive Eleme	nts of Ship Designs a
	thoroughly discussed. Typical bulding contracts and the rela	ted technical risk are introduced. The	most important main pa	arameters of a ship a
	introduced and their influence on the competitiveness of a de	sign. The lecture focusses on the influe	nce of alternated main	parameters on the tot
	performance of a ship design and the consecutive process ele	ements. In this lecture, the design chang	es are dealt with by sin	nple models or formula
	The student shall further learn to model complex systems prope	rly so that the relavent technical conclusion	ons can be drawn.	
	The lecture continues with an introduction into the different phase	ses of design project, from the initial design	an phase to a building c	ontract, Further, method
	are introduced to generate bulding specfication relevant infor			
	following topics are adressed:	,,	g	
	3			
	- 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	of seagoing mearchant ships. The goal of	of the lecture is that the	student shall be able
	carry out a concept design based on a vessel of comparison ful			
	the basic design methods to determine the fundamantal techn			
	values. Based on the lecture "Principles of Ship Design" the rele			
D 10	· · · · · · · · · · · · · · · · · · ·			
Personal Competence	The abode at lease to average to aborise another 's such a second	ha ha ana mananada his matani'at a cata	an amainsk bis same - 194-	
	The students learns to prepare technical matters in such a way			
Autonomy	The students learns to prepare technical matters in such a way	ne ne can persuade nis potantial custom	er against his competito	ors.
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): Specialisatio			
Curricula	General Engineering Science (German program, 7 semester): S		lsory	
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): S	pecialisation Naval Architecture: Compul	sory	
	Naval Architecture: Core qualification: Compulsory			

Course L1262: Ship Design	Course L1262: Ship Design	
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Stefan Krüger	
Language	DE	
Cycle	SoSe	
Content		
Literature		



Course L1264: Ship Design	
Тур	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Stefan Krüger
Language	DE
Cycle	SoSe
Content	
Literature	



Specialization Process Engineering

Process engineering is the engineering discipline that conducts research into, develops, and realizes material change processes. It deals as a cross-sectional science with the conversion of materials in their nature, their properties, or their composition by means of physical, chemical, and biological processes with a view to producing usable intermediate or end products such as fuels, sugar, synthetics, proteins, cosmetics, dyestuffs, alcohols, plant protection products, or medications.

To achieve these targets, the process engineering study program aims to enable students to recognize and formulate laws by means of which apparatus, machinery, and entire manufacturing plants can be planned, calculated, designed, built, and operated. The product qualities required are to be achieved by means of safe and environmentally compatible processes and a rational use of energy and raw materials.

Module M0886: Fundament	als of Process Engineering			
courses				
itle		Тур	Hrs/wk	СР
troduction into Process Engineering/Biop	rocess Engineering (L0829)	Lecture	2	1
undamentals of material engineering (L08	30)	Lecture	2	2
Module Responsible	Prof. Michael Schlüter			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have read	hed the following learning results		
Professional Competence				
Knowledge	After passing this module the students have the	ability to:		
	give an evention of the most important fig.	olds on process and bioprocess engineering		
		elds on process and bioprocess engineering,		
	 explain some working methods for different 	int helds in process engineering.		
Skills	After passing this module the students should ha	ive the ability to:		
	list and outline the most important fields of	of process engineering		
	·	or process engineering, iches or methods of the different fields of process eng	zinooring	
	read and prepare an engineering drawin		,inteering,	
	explain the most important technologies to			
		ogical processes independently with the aid of pointe	are.	
	scrienie typical chemical and biotechnoic	igical processes independently with the aid of pointe	15.	
Personal Competence				
Social Competence	The students are able to			
	• work out regults in groups and decument	thom		
	work out results in groups and document provide appropriate feedback and handle	e feedback on their own performance constructively.		
	provide appropriate leedback and name	ricedback of their own performance constitutivery.		
Autonomy	The students are able to estimate their progre	ss of learning by themselves and to deliberate the	ir lack of knowledge in P	rocess Engineering a
	Bioprocess Engineering.			
Workload in Hours	Independent Study Time 34, Study Time in Lectu	ire 56		
Credit points	3			
	Written exam			
	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Process Engineering: Compulsory			
Curricula): Specialisation Bioprocess Engineering: Compulsor	rv	
Janioula		, 7 semester): Specialisation Process Engineering: C		
		, 7 semester): Specialisation Process Engineering. O		
	Bioprocess Engineering: Core qualification: Con		,. compaisory	
		ipulsory : Specialisation Bioprocess Engineering: Compulsor	'v	
			,	
	General Engineering Science (English program)			
	General Engineering Science (English program)		ampulsory	
	General Engineering Science (English program,	7 semester): Specialisation Process Engineering: Computering: Computer		



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.
Literature	s. StudIP

Course L0830: Fundamentals of ma	iterial engineering		
Тур	Lecture		
Hrs/wk			
СР			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Dr. Marko Hoffmann		
Language	DE		
Cycle	WiSe		
Content	 Introduction Atomic structure and bonding Structure of solids Miller indices Imperfections in solids Texture Diffusion Mechanical properties Dislocations and strengthening mechanisms Phase transformations Phase diagrams, iron-carbon phase diagram Metallic materials Corrosion Polymeric materials Ceramic materials Ceramic materials 		
Literature	 Bargel, HJ.; Schulze, G. (Hrsg.): Werkstoffkunde. Berlin u.a., Springer Vieweg, 2012. Bergmann, W.: Werkstofftechnik 1. München u.a., Hanser, 2009. Bergmann, W.: Werkstofftechnik 2. München u.a., Hanser, 2008. Callister, W. D.; Rethwisch, D. G.: Materialwissenschaften und Werkstofftechnik: eine Einführung, Übersetzungshrsg.: Scheffler, M., 1. Auflage Weinheim, Wiley-VCH, 2013. Seidel, W. W., Hahn, F.: Werkstofftechnik. München u.a., Hanser, 2012. 		



Module M0937: Physical Ch	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	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	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	netic calculations.		
	- assess new applications with respect to environmental sustainability.			
	- abstract their knowldege to related issues to conduct thermodyn	amical, electrochemical and kinetic ca	lculations.	
Personal Competence				
Social Competence	The students are able to plan, prepare, conduct and document ex	periments according to scientific guide	elines in small groups.	
	The students are able to reflect their subject-specific knowledge of	rally in a team and to discuss it with fe	ellow students and faculty	<i>r</i> .
Autonomy	Students are able to assess their knowldege continuously on the	ir own by exemplified practice. Studer	nts are able to apply their	r knowldege discretely to
	plan, prepare and conduct experiments.			
Workload in Hours	Independent Study Time 34, Study Time in Lecture 56			
Credit points	3			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Cor	mpulsory	
	General Engineering Science (German program, 7 semester): Sp	ecialisation Bioprocess Engineering: I	Elective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program): Specialisation F	Process Engineering: Compulsory		
	General Engineering Science (English program): Specialisation E	Bioprocess Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Spe	ecialisation Process Engineering: Con	npulsory	
	General Engineering Science (English program, 7 semester): Spe	ecialisation Bioprocess Engineering: E	Elective Compulsory	
	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
L	



Course L0835: Physical Chemistry	
Тур	Laboratory Course
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Hans-Ulrich Moritz, Dr. Werner Pauer
Language	DE
Cycle	WiSe
Content	Six laboratory experiments are conducted in groups of two students. The subjects of experimental investigations are:
	Reaction kinetics
	Freezing-point depression (cryoscopy)
	Electrical mobility of ions
	Viscosimetry
	Heat of neutralization
	Surface tension
	Before the practical conduct of the experiments a colloquium takes place in which the students explain, reflect and discuss the theoretical basics and their translation into practice. The students write up a report for every experiment. They receive feedback to their level of scientific writing (citation methods, labeling of graphs, etc.), so that they can improve their competence in this field over the course of the practical course.
Literature	Skript zum Chemiepraktikum III für Verfahrenstechniker, jeweils aktuelle Version, ca. 100 Seiten, PDF-Datei zum Download unter
	http://www.chemie.uni-hamburg.de/studium/nebenfach/tuhh3/studium/nebenfach/tuhh3/studium/nebenfach/tuhh3/Praktikum_2013_2014.html



Courses	
itle	Typ Hrs/wk CP
Computer Engineering (L0321) Computer Engineering (L0324)	Lecture 3 4 Recitation Section (small) 1 2
Module Responsible	
Admission Requirements	None
Recommended Previous	Basic knowledge in electrical engineering
Knowledge	and the state of t
· ·	The successful completion of the labs will be honored during the evaluation of the module's examination according to the following rules:
	1. Upon a passed module examination, the student is granted a bonus on the examination's marks due to the successful labs, such th
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the next-better grade.
	2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is not possible.
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	
ruiomoago	gates. The module includes the following topics:
	3-1-1-1 · · · · · · · · · · · · · · · · ·
	Introduction
	Combinational logic: Gates, Boolean algebra, Boolean functions, hardware synthesis, combinational networks
	Sequential logic: Flip-flops, automata, systematic hardware design Take a logic for the form of the second s
	 Technological foundations Computer arithmetic: Integer addition, subtraction, multiplication and division
	Basics of computer architecture: Programming models, MIPS single-cycle architecture, pipelining
	Memories: Memory hierarchies, SRAM, DRAM, caches
	Input/output: I/O from the perspective of the CPU, principles of passing data, point-to-point connections, busses
Skills	The students perceive computer systems from the architect's perspective, i.e., they identify the internal structure and the physical composit
	computer systems. The students can analyze, how highly specific and individual computers can be built based on a collection of few and s
	components. They are able to distinguish between and to explain the different abstraction layers of today's computing systems - from gates and c
	up to complete processors.
	After successful completion of the module, the students are able to judge the interdependencies between a physical computer system and the so
	executed on it. In particular, they shall understand the consequences that the execution of software has on the hardware-centric abstraction layer
	the assembly language down to gates. This way, they will be enabled to evaluate the impact that these low abstraction levels have on an entire system.
	performance and to propose feasible options.
Personal Competence	
Social Competence	
Autonomy	Students are able to acquire new knowledge from specific literature and to associate this knowledge with other classes.
Autonomy Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Autonomy Workload in Hours Credit points	Independent Study Time 124, Study Time in Lecture 56
Autonomy Workload in Hours Credit points Examination	Independent Study Time 124, Study Time in Lecture 56 6 Written exam
Autonomy Workload in Hours Credit points Examination Examination duration and scale	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs
Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory
Autonomy Workload in Hours Credit points Examination Examination duration and scale	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory
Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 6 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 124, Study Time in Lecture 56 Written exam 90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
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Technomathematics: Specialisation II. Informatics: Elective Compulsory



General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Computational Science and Engineering: Core qualification: Compulsory
Mechatronics: Core qualification: Compulsory

Course L0321: Computer Engineeri	ng	
Тур	ecture	
Hrs/wk	3	
CP	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Heiko Falk	
Language	DE	
Cycle	WiSe	
Content	Introduction Combinational Logic Sequential Logic Sequential Logic Technological Foundations Representations of Numbers, Computer Arithmetics Foundations of Computer Architecture Memories Input/Output	
Literature	 A. Clements. The Principles of Computer Hardware. 3. Auflage, Oxford University Press, 2000. A. Tanenbaum, J. Goodman. Computerarchitektur. Pearson, 2001. D. Patterson, J. Hennessy. Rechnerorganisation und -entwurf. Elsevier, 2005. 	

Course L0324: Computer Engineering	ng
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Heiko Falk
Language	DE
Cycle	WiSe
Content	1. Introduction
	 Principles of digital design Analog versus Digital Gates and flip-flops Aspects of digital design Integrated cicuits Digital devices Time-to-market
	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 shifte
- 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
- 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 M0536: Fundamen	als of Fluid Mechanics			
Courses				
Fitle		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 equal 	ations		
	Integration			
Educational Objectives	After taking part successfully, students have reached the following	llowing learning results		
Professional Competence				
Knowledge	Students are able to:			
	explain the difference between different types of flow	N.		
	 give an overview for different applications of the Re 		ina	
	 explain simplifications of the Continuity- and Navier 		-	
Skills	The students are able to			
	de a college de la college de	r II		
	 describe and model incompressible flows mathema reduce the governing equations of fluid mechanics 		ne e a hy integration	
	 notice the dependency between theory and technic. 	· ·	ns e.g. by integration	
	use the learned basics for fluid dynamical application			
Personal Competence	The students			
Social Competence	The students			
	 are capable to gather information from subject relate 	ed, professional publications and relate that inf	ormation to the contex	t of the lecture and
	able to work together on subject related tasks in sm	all groups. They are able to present their result	s effectively in English	n (e.g. during small gro
	exercises)			
	 are able to work out solutions for exercises by them: 	serves, to discuss the solutions orally and to pre	esent the results.	
Autonomy	The students are able to			
	search further literature for each topic and to expand	d their knowledge with this literature		
	work on their exercises by their own and to evaluate	•		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6 Written exam			
Examination duration and scale	3 hours			
Assignment for the Following	General Engineering Science (German program): Specialis	sation Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialis			
	General Engineering Science (German program): Specialis	sation Energy and Enviromental Engineering: C	Compulsory	
	General Engineering Science (German program, 7 semeste	er): Specialisation Process Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semeste	, ,		
	General Engineering Science (German program, 7 semeste	er): Specialisation Energy and Enviromental Er	gineering: Compulso	У
	Bioprocess Engineering: Core qualification: Compulsory	0		
	Energy and Environmental Engineering: Core qualification General Engineering Science (English program): Specialis			
	General Engineering Science (English program): Specialis General Engineering Science (English program): Specialis		ompulsorv	
	General Engineering Science (English program): Specialis		pa,	
	General Engineering Science (English program, 7 semeste		ılsory	
	General Engineering Science (English program, 7 semeste			
	General Engineering Science (English program, 7 semeste	r): Specialisation Energy and Enviromental En	gineering: Compulsor	у
	Technomathematics: Specialisation III. Engineering Science	e: Elective Compulsory		
	Process Engineering: Core qualification: Compulsory			



Course L0091: Fundamentals of Flui	id Mechanics
Тур	Lecture
Hrs/wk	2
СР	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Michael Schlüter
Language	DE
Cycle	SoSe
Content	 fluid properties hydrostatic overall balances - theory of streamline overall balances- conservation equations differential balances - Navier Stokes equations irrotational flows - Potenzialströmungen flow around bodies - theory of physical similarity turbulent flows compressible flows
Literature	 Crowe, C. T.: Engineering fluid mechanics. Wiley, New York, 2009. Durst, F.: Strömungsmechanik: Einführung in die Theorie der Strömungen von Fluiden. Springer-Verlag, Berlin, Heidelberg, 2006. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994 Herwig, H.: Strömungsmechanik: Eine Einführung in die Physik und die mathematische Modellierung von Strömungen. Springer Verlag, Berlin, Heidelberg, New York, 2006 Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008 Kuhlmann, H.C.: Strömungsmechanik. München, Pearson Studium, 2007 Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2009 Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007 Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berlin, Heidelberg, 2008 Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006 van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882. White, F.: Fluid Mechanics, Mcgraw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011

Course L0092: Fluid Mechanics for I	Process Engineering
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Michael Schlüter
Language	DE
Cycle	SoSe
Content	In the exercise-lecture the topics from the main lecture are discussed intensively and transferred into application. For that, the students receive example tasks for download. The students solve these problems based on the lecture material either independently or in small groups. The solution is discussed with the students under scientific supervision and parts of the solutions are presented on the chalk board. At the end of each exercise-lecture, the correct solution is presented on the chalk board. Parallel to the exercise-lecture tutorials are held where the student solve exam questions under a set time-frame in small groups and discuss the solutions afterwards.
Literature	 Crowe, C. T.: Engineering fluid mechanics. Wiley, New York, 2009. Durst, F.: Strömungsmechanik: Einführung in die Theorie der Strömungen von Fluiden. Springer-Verlag, Berlin, Heidelberg, 2006. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994. Herwig, H.: Strömungsmechanik: Eine Einführung in die Physik und die mathematische Modellierung von Strömungen. Springer Verlag, Berlin, Heidelberg, New York, 2006. Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008. Kuhlmann, H.C.: Strömungsmechanik: München, Pearson Studium, 2007. Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2009. Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007. Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berlin, Heidelberg, 2008. Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006. van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882. White, F.: Fluid Mechanics, Mograw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011.



Courses				
Title		Тур	Hrs/wk	СР
Thermodynamics III (L0114)		Lecture	2	2
Thermodynamics III (L0140)		Recitation Section (small)	1	2
Thermodynamics III (L0142)		Recitation Section (large)	1	2
Module Responsible P	rof. Irina Smirnova			
-	one			
	lathematics, Physical Chemistry, Thermodynamic	es I and II		
Knowledge				
Educational Objectives A	fter taking part successfully, students have reach	ed the following learning results		
Professional Competence	,,,, ,			
Knowledge				
Mowedge	Starting from the very basics of thermodyna	amics, the students learn the mathematical tools to desc	cribe thermodynamic er	quilibria.
	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 p	henomena may occur	if different phases (vapor
	liquid, solid) coexist in equilibrium. Further	more the fundamentals of reaction equilibria are taught	t.	
	For different phase equilibria, several exar	mples relevant for different kinds of processes are show	vn and the necessary kr	nowledge for plotting and
	interpreting the equilibria are taught.			
Skills				
Okins	 Applying their knowledge, the students ar 	re able to identify the correct equation for the determination	nation of the equilibriur	n state and know how to
	simplify these equations meaningfully.			
	The students know models which can be	used to determine the properties of the system in the	equilibrium state and t	hey are able to solve the
	resulting mathematical relations.			
	For specific applications, they are able to s	self-reliantly find necessary physico-chemical propertie	s of compounds as well	Il as model parameters i
	literature sources.			
	Beside pure compound properties the stud	dents are capable of describing the properties of mixture	es.	
	The students know how to visualize phase	equilibria graphically and they know how to interpret th	he occurring phenomer	na.
		are able to understand fundamental concepts that a		
	processes in chemical engineering.	·	•	
Personal Competence				
· ·	ne students are able to work in small groups, to s	solve the corresponding problems and to present them	oraly to the tutors and c	other students
Autonomy	5 1 7		•	
1.5.5	·	formation self-reliantly in literature sources and to judge		
	During the semester the students are able	to check their learning progress continuously in exerc	ises. Based on this kno	wledge the students car
	adept their learning process.			
	dependent Study Time 124, Study Time in Lectu	re 56		
Credit points 6				
	/ritten exam			
	20 minutes; theoretical questions and calculation			
	0 0 1 0 7	Specialisation Process Engineering: Compulsory		
		Specialisation Bioprocess Engineering: Compulsory		
G	eneral Engineering Science (German program,	7 semester): Specialisation Process Engineering: Com	pulsory	
G	eneral Engineering Science (German program,	7 semester): Specialisation Bioprocess Engineering: Co	ompulsory	
В	ioprocess Engineering: Core qualification: Comp	pulsory		
	eneral Engineering Science (English program):	Specialisation Bioprocess Engineering: Compulsory		
G.		0 i - i' i'		
	eneral Engineering Science (English program):	Specialisation Process Engineering: Compulsory		
G		Specialisation Process Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp	oulsory	
G G	eneral Engineering Science (English program, 7		•	



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 GE-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.

Course L0140: Thermodynamics III	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	SoSe
Content	1. Introduction: Applications of thermodynamics of mixtures 2. Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity 3. Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule 4. Equations of state: virial equations, van-der-Waals equation, generalized equations of state 5. Mixing properties: ideal and real mixtures, excess properties, partial molar properties 6. Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition 7. Gas-liquid-equilibria: equilibrium condition, Henry-coefficient 8. GE-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC 9. Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems 10. Solid-liquid-equilibria: equilibrium condition, binary systems 11. Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature 12. Osmotic pressure The students work on tasks in small groups and present their results in front of all students.
Literature	 Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997.J.P. O'Connell, J.M. Haile: Thermodynamics. Cambridge University Press, 2005.



Course L0142: 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: Thermodynamics. Cambridge University Press, 2005.



ourses				
tle		Тур	Hrs/wk	СР
gnals and Systems (L0432)		Lecture	3	4
gnals and Systems (L0433)		Recitation Section (large)	1	2
Module Responsible	Prof. Gerhard Bauch			
Admission Requirements	None			
Recommended Previous	Mathematics 1-3			
Knowledge	The modul is an introduction to the theory of signals and s	stems. Good knowledge in maths as covere	d by the moduls Mat	hematik 1-3 is exped
	Further experience with spectral transformations (Fourier ser			
Educational Objectives	After taking part successfully, students have reached the following	wing learning results		
Professional Competence				
Knowledge	The students are able to classify and describe signals and li	near time-invariant (LTI) systems using metho	ods of signal and syste	em theory. They are
	to apply the fundamental transformations of continuous-time $% \label{eq:continuous} % eq:cont$	and discrete-time signals and systems. They	can describe and anal	yse deterministic sig
	and systems mathematically in both time and image doma		in time domain and in	mage domain which
	caused by the transition of a continuous-time signal to a disc			
Skills	The students are able to describe and analyse deterministic	signals and linear time-invariant systems usi	ng methods of signal	and system theory.
	can analyse and design basic systems regarding important		ponse, stability, linear	ity etc They can as
	the impact of LTI systems on the signal properties in time and	frequency domain.		
Personal Competence				
Social Competence	The students can jointly solve specific problems.			
Autonomy	The students are able to acquire relevant information from a		rol their level of know	rledge during the led
	period by solving tutorial problems, software tools, clicker sys	stem.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisa	tion Computer Science: Compulsory		
	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			
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	General Engineering Science (German program, 7 semester			
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	General Engineering Science (German program, 7 semester			
	Compulsory	story. Opeoidisation Moonamed Engineering	g, rodds Materials III	Linginicening colon
	General Engineering Science (German program, 7 semester	: Specialisation Mechanical Engineering, Foo	cus Mechatronics: Cor	npulsorv
	General Engineering Science (German program, 7 semestration of the control of the			
	Compulsory	ior, openiment mostament Engineering	, 1 0000 11100100001	noonamoar Enginee
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisat	ion Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (English program): Specialisat	ion Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisat	ion Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisat	ion Computer Science: Compulsory		
	General Engineering Science (English program): Specialisat	ion Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisat	ion Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program, 7 semester)		•	
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			maulaar:
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semes	ser). Specialisation Mechanical Engineering	y, rocus Materials in	Engineering Scien
	Compulsory General Engineering Science (English program 7 semester)	Specialization Machanical Engineering For	us Machatranias C	nuleon/
	General Engineering Science (English program, 7 semester) General Engineering Science (English program, 7 semes			
	Concrat Engineering Science (English program, / semes		, rocus medielicai N	noonamoal Enginee
	Compulsory			
	Compulsory Computational Science and Engineering: Core qualification:	Compulsory		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	S
Тур	Lecture
Hrs/wk	3
СР	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language Cycle	DE/EN SoSe
Content	Basic classification and description of continuous-time and discrete-time signals and systems
	Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)
	Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

Course L0433: Signals and Systems	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0938: Bioprocess	Engineering - Fundamentals			
Courses				
Title		Тур	Hrs/wk	СР
Bioprocess Engineering - Fundamentals (L0841)	Lecture	2	3
Bioprocess Engineering- Fundamentals (L	.0842)	Recitation Section (large)	2	1
Bioprocess Engineering - Fundamental Pr	actical Course (L0843)	Laboratory Course	2	2
Module Responsible	Prof. Andreas Liese			
Admission Requirements	none			
Recommended Previous	none, module "organic chemistry", module "fundamentals for p	rocess engineering"		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results		
Professional Competence				
Knowledge	Students are able to describe the basic concepts of biopro-			
	microorganisms, as well as to differentiate different types of in			
	processes in bioreactors can be explained. The students an	e capable to explain fundamental bioproces	ss management, ste	rilization technology a
	downstream processing in detail.			
Skills	After successful completion of this module, students should be	able to		
	•			
	 describe different kinetic approaches for growth and su 			
	 predict qualitatively the influence of energy generation, 		th inhibition on the fe	rmentation process
	analyze bioprocesses on basis of stoichiometry and to			
	 distinguish between scale-up criteria for different biore. 	actors and bioprocesses (anaerobic, aerobic	as well as microaer	obic) to compare them
	well as to apply them to current biotechnical problem			
	 propose solutions to complicated biotechnological prob 	plems and to deduce the corresponding mode	els	
	 to explore new knowledge resources and to apply the r 	newly gained contents		
	identify scientific problems with concrete industrial use			
	 to document and discuss their procedures as well as re 			
Personal Competence				
Social Competence	After completion of this module participants should be able to	debate technical questions in small teams	to enhance the abilit	ty to take position to the
	own opinions and increase their capacity for teamwork in engi	neering and scientific environments.		
Autonomy	After completion of this module participants will be able to s	solve a technical problem in a team indepe	ndently by organizir	ng their workflow and
ricionomy	present their results in a plenum.	one a teenmear presion in a team indepe	naonay by organiza	ig aren wermen and
	F			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program): Specialisation		loon.	
	General Engineering Science (German program, 7 semester): General Engineering Science (German program, 7 semester):			
		Specialisation Bioprocess Engineering: Com	ipuisory	
	Bioprocess Engineering: Core qualification: Compulsory	Birman		
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisatio		conv	
	General Engineering Science (English program, 7 semester):			
	General Engineering Science (English program, 7 semester):		puisory	
	Biomedical Engineering: Specialisation Artificial Organs and F			
	Biomedical Engineering: Specialisation Implants and Endopro			
	Biomedical Engineering: Specialisation Medical Technology a			
	Biomedical Engineering: Specialisation Management and Bus			
	Technomathematics: Specialisation III. Engineering Science: E	elective Compulsory		
	Process Engineering: Core qualification: Compulsory			



Course L0841: Bioprocess Engineering - Fundamentals		
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Andreas Liese, Prof. An-Ping Zeng	
Language	DE	
Cycle	SoSe	
Content	 Introduction: state-of-the-art and development trends in the biotechnology, introduction to the lecture Enzyme kinetics: Michaelis-Menten, differnt types of enzyme inhibition, linearization, conversion, yield, selectivity (Prof. Liese) Stoichiometry: coefficient of respiration, electron balance, degree of reduction, coefficient of yield, theoretical oxygen demand (Prof. Liese) Microbial growth kinetic: batch- and chemostat culture (Prof. Zeng) Kinetic of subtrate consumption and product formation (Prof. Zeng) Rheology: non-newtonian fluids, viscosity, agitators, energy input (Prof. Liese) Transport process in a bioreactor (Prof. Zeng) Technology of sterilization (Prof. Zeng) Fundamentals of bioprocess management: bioreactors and calculation of batch, fed-batch and continuouse bioprocesses (Prof. Zeng/Prof. Liese) Downstream technology in biotechnology: cell breakdown, zentrifugation, filtration, aqueous two phase systems (Prof. Liese) 	
Literature	K. Buchholz, V. Kasche, U. Bornscheuer: Biocatalysts and Enzyme Technology, 2. Aufl. Wiley-VCH, 2012 H. Chmiel: Bioprozeßtechnik, Elsevier, 2006 R.H. Balz et al.: Manual of Industrial Microbiology and Biotechnology, 3. edition, ASM Press, 2010 H.W. Blanch, D. Clark: Biochemical Engineering, Taylor & Francis, 1997 P. M. Doran: Bioprocess Engineering Principles, 2. edition, Academic Press, 2013	

Course L0842: Bioprocess Engineering- Fundamentals	
Тур	Recitation Section (large)
Hrs/wk	2
СР	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Andreas Liese, Prof. An-Ping Zeng
Language	DE
Cycle	SoSe
Content	1. Introduction (Prof. Liese, Prof. Zeng)
	2. Enzymatic kinetics (Prof. Liese)
	3. Stoichiometry I + II (Prof. Liese)
	4. Microbial Kinetics I+II (Prof. Zeng)
	5. Rheology (Prof. Liese)
	6. Mass transfer in bioprocess (Prof. Zeng)
	7. Continuous culture (Chemostat) (Prof. Zeng)
	8. Sterilisation (Prof. Zeng)
	9. Downstream processing (Prof. Liese)
	10. Repetition (Reserve) (Prof. Liese, Prof. Zeng)
Literature	siehe Vorlesung

Course L0843: Bioprocess Engineering - Fundamental Practical Course		
Тур	Laboratory Course	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Andreas Liese, Prof. An-Ping Zeng	
Language	DE	
Cycle	SoSe	
Content	In this course fermentation and downstream technologies on the example of the production of an enzyme by means of a recombinant microorganism is learned. Detailed characterization and simulation of enzyme kinetics as well as application of the enzyme in a bioreactor is carried out. The students document their experiments and results in a protocol.	
Literature	Skript	



Module M0538: Heat and M				
Courses				
Title		Тур	Hrs/wk	СР
Heat and Mass Transfer (L0101)		Lecture	2	4
Heat and Mass Transfer (L0102)		Recitation Section (small)	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	earning results		
Professional Competence				
Knowledge	The state of second state of s	to and the control of the first based to a few to		/a haat and an
	 The students are capable of explaining qualitative and de chemical reactors). 	termining quantitative neat transfer in	procedural apparati	is (e. g. neat exchanç
	They are capable of distinguish and characterize different k	inds of heat transfer mechanisms name	elv heat conduction.	heat transfer and then
	radiation.		,	
	The students have the ability to explain the physical basis for	r mass transfer in detail and to describ	e mass transfer quali	tative and quantitative
	using suitable mass transfer theories.			
	They are able to depict the analogy between heat- and mas	transfer and to describe complex linke	d processes in detail	
Skills	• The students are able to get reasonable aveter boundaries	o for a given transport problem by usi	na the animed knowl	adaa and ta balansa
	 The students are able to set reasonable system boundarie corresponding energy and mass flow, respectively. 	s for a given transport problem by using	ig the gamed known	edge and to balance
	They are capable to solve specific heat transfer problems	e.g. heated chemical reactors, temper	ature alteration in flu	iids) and to calculate
	corresponding heat flows.			,
	Using dimensionless quantities, the students can execute so	aling up of technical processes or appa	aratus.	
	They are able to distinguish between diffusion, convective	mass transition and mass transfer. The	ey can use this know	rledge for the descript
	and design of apparatus (e.g. extraction column, rectification	column).		
	In this context, the students are capable to choose and		d mass exchanger f	or a specific applica
	considering their advantages and disadvantages, respective			
	 In addition, they can calculate both, steady-state and non-st The students are capable to connect their knowledge of 			In particular the cour
	thermodynamics, fluid mechanics and chemical process eng			in particular the cour
Personal Competence				
Social Competence	The students are capable to work on subject-specific challe	nges in teams and to present the resul	te orally in a reasons	thle manner to tutore
	other students.	nges in teams and to present the resul	is orany in a reasone	tole manner to tators a
	outer education			
Autonomy				
	They are able to prove their level of knowledge during.		dura continuously (oliakar ayatam ayam
	 They are able to prove their level of knowledge during assignments) and on this basis they can control their learning 		dure continuously (nicker-system, exam-
	assignments) and on this basis they can control their learning	у ргосеззез.		
Workload in Hours	Independent Study Time 138, Study Time in Lecture 42			
Credit points	6			
Examination				
Examination duration and scale	120 minutes; theoretical questions and calculations	acces Engineering October		
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation Pr General Engineering Science (German program): Specialisation Bi			
Odificula	General Engineering Science (German program): Specialisation Er		ompulsory	
	General Engineering Science (German program, 7 semester): Spec			
	General Engineering Science (German program, 7 semester): Spec			
	General Engineering Science (German program, 7 semester): Spec			ry
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compu	sory		
	General Engineering Science (English program): Specialisation Bio			
	General Engineering Science (English program): Specialisation En		mpulsory	
	General Engineering Science (English program): Specialisation Pro			
	General Engineering Science (English program, 7 semester): Spec		•	
	General Engineering Science (English program, 7 semester): Spec General Engineering Science (English program, 7 semester): Spec	, , , , , , , , , , , , , , , , , , , ,		W
	Technomathematics: Specialisation III. Engineering Science: Elective	• • • • • • • • • • • • • • • • • • • •	meemig. Compuisor	у
	Technomathematics: Core qualification: Elective Compulsory	pa-oo-,		

Process Engineering: Core qualification: Compulsory



Course L0101: Heat and Mass Transfer	
Тур	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	1. Heattransfer
	Introduction, one-dimensional heat conduction
	Convective heat transfer
	Multidimensional heat conduction
	Non-steady heat conduction
	Thermal radiation
	2. 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
	2. Volvanilidada

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	
	Heat transfer
	Introduction, one-dimensional heat conduction
	Convective heat transfer Multidimensional heat conduction
	Non-steady heat conduction Thermal radiation
	2. 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
	The students work on tasks in small groups and present their results in front of all students.
Literature	H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer
	2. VDI-Wärmeatlas
	2. VDFWattileauas



Module M0546: Thermal Se	eparation Processes			
Courses				
Title		Тур	Hrs/wk	СР
Thermal Separation Processes (L0118)		Lecture	3	3
Thermal Separation Processes (L0119)		Recitation Section (small)	2	1
Thermal Separation Processes (L0141)		Recitation Section (large)	1	1
Separation Processes (L1159)		Laboratory Course	1	1
Module Responsible	Prof. Irina Smirnova			
Admission Requirements	None			
Recommended Previous Knowledge	Recommended requirements: Thermodynamics III			
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence				
Knowledge	The students can distinguish and describe different types of s The students develop an understanding for the course of courses, the possibilities of energy saving, and the selection They have good knowledge of designing methods for separa	ncentration during a separation proce 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 associated energy and material balances The students can use different graphical methods for the designing of a separation process and define the amount of theoretical stages required They can select and design a basic type of thermal separation process for a given case based on the advantages and disadvantages of the process The students are capable to obtain independently the needed material properties from appropriate sources (diagrams and tables) They can calculate continuous and discontinuous processes The students are able to prove their theoretical knowledge in the experimental lab work. The students are able to discuss the theoretical background and the content of the experimental work with the teachers in colloquium. The students are capable of linking their gained knowledge with the content of other lectures and use it together for the solution of technical problems. Other lectures such as thermodynamics, fluid mechanics and chemical engineering. 			
Personal Competence Social Competence	The students can work technical assignments in small groups The students are able to carry out practical lab work in small			n them. They are able to
	discuss their results and to document them scientifically in a			urom. rrioj aro abro to
Autonomy	The students are capable to obtain the needed information from the students can proof the state of their knowledge with example of their knowledge with example of the students can proof the state of their knowledge.			ing process
Workload in Hours	Independent Study Time 82, Study Time in Lecture 98			
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 Pro	cess Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Bio			
	General Engineering Science (German program): Specialisation Eng		ompulsory	
	General Engineering Science (German program, 7 semester): Speci	**		
	General Engineering Science (German program, 7 semester): Speci			
	General Engineering Science (German program, 7 semester): Speci			y
	Bioprocess Engineering: Core qualification: Compulsory		, g : pa.ooi	•
	Energy and Environmental Engineering: Core qualification: Compuls	orv		
	General Engineering Science (English program): Specialisation Biop	*		
	General Engineering Science (English program): Specialisation Engineering Science (English program): S		ımnulsorv	
	General Engineering Science (English program): Specialisation Programs (English program): Specialisation Programs (English program): Specialisation Programs (English programs): Specialisation Programs (English programs)		ппривогу	
			corv	
	General Engineering Science (English program, 7 semester): Special			
	General Engineering Science (English program, 7 semester): Special			,
	General Engineering Science (English program, 7 semester): Special	oaon Energy and Environmental Eng	mooning. Compuisor)	
	Process Engineering: Core qualification: Compulsory			



Course L0118: Thermal Separation I	Processes	
Тур	Lecture	
Hrs/wk	3	
СР	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	WiSe	
Content	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes	
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry's Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann's Enzyklopädie der Technischen Chemie 	



Course L0119: Thermal Separation Processes		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	WiSe	
Content	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes The students work on tasks in small groups and present their results in front of all students.	
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann"s Enzyklopädie der Technischen Chemie 	



Course L0141: Thermal Separation Processes		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Irina Smirnova	
Language	DE	
Cycle	WiSe	
Content	Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes	
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkopff, Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann's Enzyklopädie der Technischen Chemie 	



Course L1159: Separation Processe	es <u> </u>	
Тур	Laboratory Course	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Course work	Compulsory attendence of the colloquia of all experiments and compulsory report.	
Lecturer	Prof. Irina Smirnova	
Language	DE/EN	
Cycle	SoSe	
Content	The students work on eight different experiments in this practical course. For every one of the eight experiments, a colloquium takes place in which the	
	students explain and discuss the theoretical background and its translation into practice with staff and fellow students.	
	The students work small groups with a high degree of division of labor. For every experiment, the students write a report. They receive instructions i terms of scientific writing as well as feedback on their own reports and level of scientific writing so they can increase their capabilities in this area. Topics of the practical course:	
	 Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes Membrane separation Energy demand of separation processes Advance overview of separation processes Selection of separation processes 	
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. 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 	



Module M0892: Chemical R	eaction Engineering			
Courses				
Title		Тур	Hrs/wk	СР
Chemical Reaction Engineering (Fundamentals) (L0204)		Lecture	2	2
Chemical Reaction Engineering (Fundame	ntals) (L0244)	Recitation Section (large)	2	2
Experimental Course Chemical Engineering (Fundamentals) (L0221) Laboratory Course 2 2				
Module Responsible	Prof. Raimund Horn			
Admission Requirements	None			
Recommended Previous	Contents of the previous modules mathematics I-III, physical	sical chemistry, technical thermodynamics I+II as w	rell as computational r	nethods for engineers.
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge	The students are able to explain basic concepts of cher	mical reaction engineering. They are able to point	out differences betwe	en thermodynamical and
	kinetical processes. The students have a strong ability to	o outline parts of isothermal and non-isothermal id	eal reactors and to de	scribe their properties.
Skills	After successful completion of the module, students are	able to:		
	- apply different computational methods to dimension is	othermal and non-isothermal ideal reactors,		
	- determine and compute stable operation points for the	se reactors ,		
	- conduct experiments on a lab-scale pilot plants and document these according to scientific guidelines.			
Personal Competence				
Social Competence	After successful completition of the lab-course the students have a strong ability to organize themselfes in small groups to solve issues in chemica			solve issues in chemica
	reaction engineering. The students can discuss their sul	bject related knowledge among each other and wi	th their teachers.	
Autonomy	The students are able to obtain further information and	d assess their relevance autonomously. Students	can apply their know	dege discretely to plan
	prepare and conduct experiments.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Speci	alisation Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Speci			
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory			
	General Engineering Science (German program, 7 sem	ester): Specialisation Bioprocess Engineering: Co	mpulsory	
	Bioprocess Engineering: Core qualification: Compulsor	у		
	General Engineering Science (English program): Speci	alisation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specia	alisation Process Engineering: Compulsory		
	General Engineering Science (English program, 7 seme	ester): Specialisation Process Engineering: Compu	ılsory	
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory			
	Process Engineering: Core qualification: Compulsory			

Тур	Lecture
Hrs/wk	2
CP 2	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Raimund Horn
Language	DE
Cycle	WiSe
	Fundamentals of chemical reaction engineering, definitions, calculation of species concentrations (reactor, reaction mixture, reactants, products, ine and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentration, mas concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, conversic selectivity, yield, concentration calculations in stationary and flowing multicomponent-mixtures)
Stoichiometry and stoichiometric calculations (simple reactions, complex reactions, key reactions, key species, matrix of dependent and independent reactions, element-species-matrix, row reduced form of a matrix, rank of a matrix, Gar between stoichiometry and kinetics, calculating the extent of reaction from mole number changes in complex reactions)	
1 1 1	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, standarcheat 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 reactionsystems, Lagrange Multipliers)
1	Chemical kinetics (reversible and irreversible reactions, homogeneous and heterogeneous reactions, elementary step, reaction mechanismicrokinetics, 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 integrethed of kinetic analysis, laboratory reactors for kinetic measurements, half life, kinetics of complex reactions, parallel reactions, reversible reaction sequence of reactions, irreversible reaction with pre-equilibrium, reduction of reaction mechanisms, quasi-stationarity principle of Bodenstein, rallimiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of complainted integration of



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

skrint Frerich Keil

Books:

- M. Baerns, A. Behr, A. Brehm, J. Gmehling, H. Hofmann, U. Onken, A. Renken, Technische Chemie, Wiley-VCH
- G. Emig, E. Klemm, Technische Chemie, Springer
- A. Behr, D. W. Agar, J. Jörissen, Einführung in die Technische Chemie
- E. Müller-Erlwein, Chemische Reaktionstechnik 2012, 2. Auflage, Teubner Verlag
- J. Hagen, Chemiereaktoren: Auslegung und Simulation, 2004, Wiley-VCH
- H. S. Fogler, Elements of Chemical Reaction Engineering, Prentice Hall B
- $\hbox{H.\,S.\,Fogler,\,Essentials\,of\,Chemical\,\,Reaction\,\,Engineering,\,Prentice\,\,Hall}$
- O. Levenspiel, Chemical Reaction Engineering, John Wiley & Sons, 1998
- L. D. Schmidt, The Engineering of Chemical Reactions, Oxford Univ. Press, 2009
- J. B. Butt, Reaction Kinetics and Reactor Design, 2000, Marcel Dekker
- R. Aris, Elementary Chemical Reactor Analysis, Dover Pubn. Inc., 2000
- $\hbox{M.\,E.\,Davis,\,R.\,J.\,Davis,\,Fundamentals\,of\,Chemical\,\,Reaction\,\,Engineering,\,McGraw\,\,Hill}$
- G. F. Froment, K. B. Bischoff, J. De Wilde, Chemical Reactor Analysis and Design, John Wiley & Sons, 2010
- A. Jess, P. Wasserscheid, Chemical Technology An Integrated Textbook, WILEY-VCH



Tree	ngineering (Fundamentals) Recitation Section (large)
	Pechalion Section (large)
	2
	Independent Study Time 32, Study Time in Lecture 28
	Prof. Raimund Horn, Dr. Oliver Korup
Language	DE
Cycle	WiSe
	Fundamentals of chemical reaction engineering, definitions, calculation of species concentrations (reactor, reaction mixture, reactants, products, ir and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentration, m
	concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, 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, li dependent and independent reactions, element-species-matrix, row reduced form of a matrix, rank of a matrix, Gauss Jordan elimination, relabetween stoichiometry and kinetics, calculating the extent of reaction from mole number changes in complex reactions)
	Thermodynamics (What is thermodynamics?, importance of thermodynamics in chemical reaction engineering, zeroth law of thermodynamics temperature scales, temperature measurements in praxis, first law of thermodynamics, internal energy, enthalpy, calorimeter, heat of reaction, stanheat of formation, Hess law, heat capacity, Kirchhoff law, standard heat of reaction, pressure dependence of the heat of reaction, second lathermodynamics, reversible and irreversible processes, entropy, Clausius inequality, free energy, Gibbs Energy, chemical potential, chemequilibrium, activity, van't Hoff law, calculation of chemical equilibrium, principle of Le Chatelier and Braun, equilibrium calculations in multiple reactions, Lagrange Multipliers)
	Chemical kinetics (reversible and irreversible reactions, homogeneous and heterogeneous reactions, elementary step, reaction mechanized 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 integrated of kinetic analysis, laboratory reactors for kinetic measurements, half life, kinetics of complex reactions, parallel reactions, reversible react sequence of reactions, irreversible reaction with pre-equilibrium, reduction of reaction mechanisms, quasi-stationarity principle of Bodenstein, limiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of comkinetics)
	Types of chemical Reaktors (chemical reactors in industry and laboratory, ideal vs. real reaktors, discontinuous, half continuous and continuous reacting phase - biphasic- and multiphase reactors, batch-reactor, semi-batch reactor, CSTR, Plug Flow reactor, fixed bed reactor, adiabatic stareactors, 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 variance, 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, n 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
	O. F. Francock V. D. Discheff, J. D. Wilde, Observed Day of Australia and Daylor Library 100 and 100 a
	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.		
1.11	Leaves 10 Objects to a classical and the Wile of Ocean New York of Education (P)		
Literature	Levenspiel, O.: Chemical reaction engineering; John Wiley & Sons, New York, 3. Ed., 1999 VTM 309(LB)		
	Praktikumsskript		
	Skript Chemische Verfahrenstechnik 1 (F.Keil)		
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Courses				
Title		Тур	Hrs/wk	CP
Practical Course: Measurement and Cont		Laboratory Course	2	2
Measurement Technology for Mechanical		Lecture	2	3
Measurement Technology for Mechanical		Recitation Section (large)	I	I
Module Responsible	Dr. Sven Krause			
Admission Requirements	none			
Recommended Previous	Basic knowledge of physics, chemistry and electrical engineering	ig .		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	Students are able to name the most important fundmentals of t	he Measurement Technology (Quantities	and Units, Uncertainty	, Calibration, Static
	Dynamic Properties of Sensors and Systems).			
	They can outline the most important measuring methods for diff	erent kinds of quantities to be maesured	(Electrical Quantities.]	emperature, mechan
	quantities, Flow, Time, Frequency).	orone mines or quantities to so massarea ,	(E.Ootioa. Quaritioo,	omporatoro, moorian
	quantities, rion, rine, rioqueney).			
	They can describe important methods of chemical Analysis (Gas	s Sensors, Spectroscopy, Gas Chromatogi	raphy)	
Skills	Students can select suitable measuring methods to given proble	ems and can use refering measurement de	evices in practice.	
	The state of the s			Landa de la Carre
	The students are able to orally explain issues in the subject area of measurement technology and solution approaches as well as place the issues in			
	the right context and application area.			
Personal Competence				
Social Competence	Students can arrive at work results in groups and document ther	m in a common report.		
Autonomy	Students are able to familiarize themselves with new measurem	ent technologies.		
<u> </u>				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	105 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation	n Energy and Enviromental Engineering: 0	Compulsory	
Curricula	General Engineering Science (German program): Specialisation	n Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program): Specialisation	n Process Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): S	pecialisation Energy and Enviromental Er	ngineering: Compulsor	у
	General Engineering Science (German program, 7 semester): S	pecialisation Mechanical Engineering: Co	ompulsory	
	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester): S		oulsory	
	Energy and Environmental Engineering: Core qualification: Con			
	General Engineering Science (English program): Specialisation		Compulsory	
	General Engineering Science (English program): Specialisation	0 0 1 ,		
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): Sp	**		/
	General Engineering Science (English program, 7 semester): Sp		, ,	
	General Engineering Science (English program, 7 semester): Sp	* *		
	General Engineering Science (English program, 7 semester): Sp	pecialisation Process Engineering: Compr	ulsory	
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Process Engineering: Core qualification: Compulsory			



ourse L1119: Practical Course: Me	easurement and Control Systems
Тур	Laboratory Course
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Wolfgang Schröder
Language	DE
Cycle	WiSe/SoSe
Content	Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous 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	nology for Mechanical and Process Engineers
Тур	
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer Language	Dr. Sven Krause DE
Cycle	WiSe
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	



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e oduction to Control Systems (L0654)	Typ Hrs/wk CP Lecture 2 4
oduction 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 seco
	systems
	They can explain the dynamics of simple control loops and interpret dynamic properties in terms of frequency response and root locus
	They can explain the Nyquist stability criterion and the stability margins derived from it.
	They can explain the role of the phase margin in analysis and synthesis of control loops
	They can explain the way a PID controller affects a control loop in terms of its frequency response
	They can explain issues arising when controllers designed in continuous time domain are implemented digitally
Skills	
	 Students can transform models of linear dynamic systems from time to frequency domain and vice versa They can simulate and assess the behavior of systems and control loops
	They can design PID controllers with the help of heuristic (Ziegler-Nichols) tuning rules
	They can analyze and synthesize simple control loops with the help of root locus and frequency response techniques
	They can calculate discrete-time approximations of controllers designed in continuous-time and use it for digital implementation
	They can use standard software tools (Matlab Control Toolbox, Simulink) for carrying out these tasks
Personal Competence	
Social Competence	
Autonomy	
Adionomy	problems.
	They can assess their knowledge in weekly on-line tests and thereby control their learning progress.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Workload in Hours Credit points	
	6
Credit points	6 Written exam
Credit points Examination	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory
Credit points Examination Examination duration and scale	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Dioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Ge
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: C
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil 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. Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Scompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Ingineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory General Engineering: Core qualification: Compulsory General Eng
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Scompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Scompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory General Engineering: Core qualification: Compulsory General Engin
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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. Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Scompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science Ingineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering: Core qualification: Compulsory General Engineering: Core qualification: Compulsory General Eng
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Filter (Specialisation Program): General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Program Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Com
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (Engilish program, 7 semester): Sp
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 120 min General Engineering Science (German program): Core qualification: Compulsory General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Procompulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical



General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Specialisation Engineering Science: Elective Compulsory

Mechanical Engineering: Core qualification: Compulsory

Mechatronics: Core qualification: Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Theoretical Mechanical Engineering: Technical Complementary Course Core Studies: Elective Compulsory

Process Engineering: Core qualification: Compulsory

e L0654: Introduction to Contr	ol Systems	
Тур	Lecture	
Hrs/wk	2	
СР	4	
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28	
Lecturer	Prof. Herbert Werner	
Language	DE	
Cycle	WiSe	
Content	Signals and systems	
	Linear systems, differential equations and transfer functions	
	First and second order systems, poles and zeros, impulse and step response	
	Stability	
	Feedback systems	
	Principle of feedback, open-loop versus closed-loop control	
	Reference tracking and disturbance rejection	
	Types of feedback, PID control	
	System type and steady-state error, error constants	
	Internal model principle	
	loot locus techniques	
	Root locus plots	
	Root locus design of PID controllers	
	Frequency response techniques	
	Bode diagram Minimum and non minimum phase systems.	
	Minimum and non-minimum phase systems	
	Nyquist plot, Nyquist stability criterion, phase and gain margin	
	Loop shaping, lead lag compensation Fraguency response interpretation of PID control	
	Frequency response interpretation of PID control	
	Time delay systems	
	Root locus and frequency response of time delay systems	
	Smith predictor	
	Digital control	
	Sampled-data systems, difference equations	
	Tustin approximation, digital implementation of PID controllers	
	Software tools	
	Introduction to Matlab, Simulink, Control toolbox	
	Computer-based exercises throughout the course	
Literature	Werner, H., Lecture Notes "Introduction to Control Systems"	
	G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009	
	K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010	
	R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010	



Course L0655: Introduction to Control Systems		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Herbert Werner	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1275: Environme	ntal Technology			
Courses				
Title		Тур	Hrs/wk	CP
Practical Exercise Environmental Technology (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 le	arning results		
Professional Competence				
Knowledge	With the completion of this modul the students obtain profound kn	owledge of environmental technolo	gy. They are able to d	escribe the behaviour of
	chemicals in the environment. Students can give an overview of s	cientific disciplines involved. They	can explain terms and	allocate them to related
	methods.			
01.71		and the second s	bloom Thomas abla to	data and a constant and
Skills	Students are able to propose appropriate management and mitigati	·	•	-
	parameters and to assess the potential of pollutants to migrate a			·
	Environmental Technology contributes to sustainable development,	and they can present and detend the	ese opinons in front of a	nd against the group.
Personal Competence				
Social Competence	The students are able to discuss the various technical and scientific	tasks, both subject-specific and mu	Itidisciplinary. They are	able to develop different
	approaches to the task as a group as well as to discuss their theoreti	cal or practical implementation.		
Autonomy	Students can independently exploit sources about of the subject, acc	quire the particular knowledge and tr	anfer it to new problems	S.
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Examination	Written exam			
Examination duration and scale	1 hour written exam			
Assignment for the Following	General Engineering Science (German program): Specialisation Eng	ergy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specialisation Pro	cess Engineering: Elective Compuls	sory	
	General Engineering Science (German program, 7 semester): Speci	alisation Energy and Enviromental E	Engineering: Compulsor	у
	General Engineering Science (German program, 7 semester): Speci	alisation Process Engineering: Elect	tive Compulsory	
	General Engineering Science (German program, 7 semester): Speci	alisation Bioprocess Engineering: E	lective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsory			
	Energy and Environmental Engineering: Core qualification: Compuls	sory		
	General Engineering Science (English program): Specialisation Ene	rgy and Enviromental Engineering:	Compulsory	
	General Engineering Science (English program): Specialisation Pro	cess Engineering: Elective Compuls	ory	
	General Engineering Science (English program, 7 semester): Specia	alisation Energy and Enviromental E	ngineering: Compulsor	/
	General Engineering Science (English program, 7 semester): Specia	alisation Process Engineering: Electi	ve Compulsory	
	General Engineering Science (English program, 7 semester): Specia	alisation Bioprocess Engineering: El	ective Compulsory	
	Process Engineering: Core qualification: Elective Compulsory			

Course L1387: Practical Exercise Environmental Technology		
Тур	Laboratory Course	
Hrs/wk		
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Joachim Gerth	
Language	DE	
Cycle	SoSe	
	The experiment demonstrates the effect of ionic strength on the binding of dissolved zinc and phosphate by soil surfaces. From the results it can be inferred that the potential of soil surfaces is modified by the application of salt. This has consequences for the retention of nutrients and pollutants. The experiment is carried out with iron oxide rich soil material. Within the lab course students discuss the various technical and scientific tasks, both subject-specific and multidisciplinary. They discuss different approaches to the task as well as it's theoretical or practical implementation.	
Literature	F. Scheffer und P. Schachtschabel (2002): "Lehrbuch der Bodenkunde" TUB Signatur AGG-308 W.E.H. Blum (2007): "Bodenkunde in Stichworten" TUB Signatur AGG-317 C. A. J. Appelo; D. Postma (2005): "Geochemistry, groundwater and pollution" TUB Signatur GWC-515	



Course L0326: Environmental Tech	nologie
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Joachim Gerth, Prof. Martin Kaltschmitt, Prof. Kerstin Kuchta
Language	DE
Cycle	WiSe
Content	1. Introductory seminar on environmental science: 2. Environmental impact and adverse effects 3. Wastewater technology 4. Air pollution control 5. Noise protection 6. Waste and recycling management 7. Soil and ground water protection 8. Renewable energies 9. Resource conservation and energy efficiency
Literature	Förster, U.: Umweltschutztechnik; 2012; Springer Berlin (Verlag) 8., Aufl. 2012; 978-3-642-22972-5 (ISBN)



Module M0539: Process an	nd Plant Engineering I			
	5 5			
Courses				
Title		Тур	Hrs/wk	CP
Process and Plant Engineering I (L0095)		Lecture	2	2
Process and Plant Engineering I (L0096) Process and Plant Engineering I (L1214)		Recitation Section (large) Recitation Section (small)	1	2
Module Responsible	Prof. Georg Fieg	Recitation Section (Smail)	ı	2
Admission Requirements Recommended Previous	none			
Knowledge	unit operation of thermal an dmechanical separation processes			
Knowledge	chemical reactor eingineering			
Educational Objectives	After taking part successfully, students have reached the following lea	arning results		
Professional Competence				
Knowledge	students can:			
	classify and formulate blobal balance equations of chemical processes	es		
	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	of product streams		
	- estimation of component streams of chemical plants using linear col	mponent 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 Prod	cess Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Biop	process Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specia	llisation Process Engineering: Compu	Isory	
	General Engineering Science (German program, 7 semester): Specia			
	General Engineering Science (German program, 7 semester): Specia	lisation Energy and Enviromental Eng	ineering: Elective Co	ompulsory
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Biop			
	General Engineering Science (English program): Specialisation Proc	0 0 1 7		
	General Engineering Science (English program, 7 semester): Specia			
	General Engineering Science (English program, 7 semester): Specia			
	General Engineering Science (English program, 7 semester): Specia	iisalion Energy and Enviromental Eng	meering: ⊨lective Co	mpulsory
	Process Engineering: Core qualification: Compulsory			

Course L0095: Process and Plant Engineering I	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Course work	none
Lecturer	Prof. Georg Fieg
Language	DE
Cycle	SoSe
Content	1. Introduction Structure and operation of production plants Operational business process Technical process design Motivation and targets of process development Life cycle of production plants 2. Engineering methods and tools Mass and energy balances Strategies of process synthesis Graphical representation of processes Multidimensional regression



Module Manual B. Sc	. "General Engineering Science (English program, 7 semester)"	emburg-Ha
	Data reconciliation and data validation 3. Process Synthesis Decision levels Experimental process development Reactor synthesis Synthesis of separation processes (process alternatives and criteria for selection) Integration of reaction systems/separation systems (interactions, recycle streams) 4. Process safety 5. Cost estimation of production plants Production costs, capital costs, economic evaluation	
Literature		
	S.D. Barnicki, J.R. Fair, Ind. End. Chem., 29(1990), S. 421, Ind. End. Chem., 31(1992), S. 1679	
	H. Becker, S. Godorr, H. Kreis, Chemical Engineering, January 2001, S. 68-74	
	Behr, W. Ebbers, N. Wiese, ChemIngTech. 72(2000)Nr. 10, S.1157	
	E. Blass, Entwicklung verfahrenstechnischer Prozesse, Springer-Verlag, 2. Auflage 1997	
	M. H. Bauer, J. Stichlmair, ChemIngTech., 68(1996), Nr. 8, 911-916	
	R. Dittmeyer, W. Keim, G. Kreysa, A. Oberholz, Chemische Technik. Prozesse und Produkte,	
	Band 2, Neue Technologien, 5. Auflage, Wiley-VCH GmbH&Co.KGaA, Weinheim, 2004	
	J.M. Douglas, Conceptual Design of Chemical Processes, Mc Graw-Hill, NY, 1988	
	G. Fieg, Inz. Chem. Proc., 5(1979), S.15-19	
	G. Fieg, G. Wozny, L. Jeromin, Chem. Eng. Technol. 17(1994),5, 301-306	
	G. Fieg, Heat and Mass Transfer 32(1996), S. 205-213	
	G. Fieg, Chem. Eng. Processing, Vol. 41/2(2001), S. 123-133	
	U.H. Felcht, Chemie eine reife Industrie oder weiterhin Innovationsmotor, Universitätsbuchhandlung Blazek und Bergamann, Frankfurt, 2000	
	J.P. van Gigch, Systems Design, Modeling and Metamodeling, Plenum Press, New York, 1991	
	T.F. Edgar, D.M. Himmelblau, L.S. Lasdon, Optimization of Chemical Processes, McGraw-Hill, 2001	
	G. Gruhn, Vorlesungsmanuskript "Prozess- und Anlagentechnik, TU Hamburg-Harburg	
	D. Hairston, Chemical Engineering, October 2001, S. 31-37	
	J.L.A. Koolen, Design of Simple and Robust Process Plants, Wiley-VCH, Weinheim, 2002	
	J. Krekel, G. Siekmann, ChemIngTech. 57(1985)Nr. 6, S. 511	
	K. Machej, G. Fieg, J. Wojcik, Inz. Chem. Proc., 2(1981), S.815-824	
	S. Meier, G. Kaibel, ChemIngTech. 62(1990)Nr. 13, S.169	
	J. Mittelstraß, ChemIngTech. 66(1994), S. 309	
	P. Li, M. Flender, K. Löwe, G. Wozny, G. Fieg, Fett/Lipid 100(1998), Nr. 12, S. 528-534	
	G. Kaibel, Dissertation, TU München, 1987	
	G. Kaibel, ChemIngTech. 61 (1989), Nr. 2, S. 104-112	

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	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Course work	none
Lecturer	Prof. Georg Fieg
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Course L1214: Process and Plant Engineering I	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Course work	none
Lecturer	Prof. Georg Fieg
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0670: Particle Ted	chnology and Solids Process Engineering			
0				
Courses		Time	I lua fude	CP
		Typ Lecture	Hrs/wk 2	3
Particle Technology I (L0434) Particle Technology I (L0435)		Recitation Section (small)	1	1
Particle Technology I (L0440)	Hecitation Section (small) 1 1 Laboratory Course 2 2			
Module Responsible	Prof. Stefan Heinrich	<u> </u>		
Admission Requirements	None			
Recommended Previous	keine			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	After successful completion of the module students are able to			
	 name and explain processes and unit-operations of solids 	process engineering.		
	characterize particles, particle distributions and to discuss.			
	7			
Skills	Students are able to			
	choose and design apparatuses and processes for solids processes.	* *	ids properties of the pro	duct
	 asses solids with respect to their behavior in solids process document their work scientifically. 	sing steps		
	document their work scientifically.			
Personal Competence				
Social Competence	The students are able to discuss scientific topics orally with other	students or scientific personal and to de	evelop solutions for tech	nnical-scientific issues ir
	a group.			
Autonomy				
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 F			
Curricula	General Engineering Science (German program): Specialisation E			
	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 E	ngineering: Compulsor	/
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Comp	•		
	General Engineering Science (English program): Specialisation B			
	General Engineering Science (English program): Specialisation E		Compulsory	
	General Engineering Science (English program): Specialisation P			
	General Engineering Science (English program, 7 semester): Spe		•	
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe	cialisation Energy and Enviromental Er	igineering: Compulsory	
	Process Engineering: Core qualification: Compulsory			



Course L0434: Particle Technology	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	 Description of particles and particle distributions Description of a separation process Description of a particle mixture Particle size reduction Agglomeration, particle size enlargement Storage and flow of bulk solids Basics of fluid/particle flows classifying processes Separation of particles from fluids Basic fluid mechanics of fluidized beds Pneumatic and hydraulic transport
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.

Course L0435: Particle Technology I	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0440: Particle Technology	l .
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	 Sieving Bulk properties Size reduction Mixing Gas cyclone Blaine-test, filtration Sedimentation
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.



ourses				
tle		Тур	Hrs/wk	CP
troduction to Management (L0880)		Lecture	3	3
roject Entrepreneurship (L0882)	Drof Christoph Ibl	Problem-based Learning	2	3
Module Responsible				
Admission Requirements Recommended Previous				
Knowledge	Dasic Knowledge of Mathematics and Dusiness			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge			agement, from Planr	ning and Organisation
	Marketing and Innovation, and also to Investment and Controlling.	In particular they are able to		
	explain the differences between Economics and Managem	ent and the sub-disciplines in Manageme	ent and to name impo	rtant definitions from t
	field of Management			
	explain the most important aspects of and goals in Manage			
	describe and explain basic business functions as product		chain management, o	organization and hum
	 ressource management, information management, innovat explain the relevance of planning and decision making in 		tinle objectives and	uncertainty and evola
	some basic methods from mathematical Finance	Dusiness, esp. in situations under mu	upie objectives and	uncertainty, and expire
	state basics from accounting and costing and selected confi	rolling methods.		
01.111				
Skills	Students are able to analyse business units with respect to Entrepreneurship project in a team. In particular, they are able to	different criteria (organization, object	ives, strategies etc.) and to carry out
	analyse Management goals and structure them appropriate	ely		
	analyse organisational and staff structures of companies apply methods for decision making under multiple objective	oc under upcortainty and upder rick		
	 apply methods for decision making under multiple objective analyse production and procurement systems and Busines 			
	analyse and apply basic methods of marketing	o miorinaison o potentio		
	select and apply basic methods from mathematical finance	to predefined problems		
	apply basic methods from accounting, costing and controlli	ng to predefined problems		
Personal Competence				
Social Competence				
	work successfully in a team of students		and the constraint	
	to apply their knowledge from the lecture to an entrepreneu to communicate appropriately and	rsnip project and write a conerent report	on the project	
	to constructe 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			
Credit points	Written exam			
Credit points Examination	Written exam 90 Minuten	lectrical Engineering: Compulsory		
Credit points Examination Examination duration and scale	Written exam 90 Minuten General Engineering Science (German program): Specialisation E			
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisation E	omputer Science: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation P General Engineering Science (German program): Specialisation B	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory		
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Credit points Examination Examination duration and scale Assignment for the Following	Written exam 90 Minuten General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation B General Engineering Science (German program): Specialisation B 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 B General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory nergy and Enviromental Engineering: Coivil- and Enviromental Engeneering: Conlechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compulsion process Engineering: Compulsion pr	npulsory	
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Compulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production

ompulsory

General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Civil- and Environmental Engineering: Core qualification: Compulsory

Bioprocess Engineering: Core qualification: Compulsory

Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory

Energy and Environmental Engineering: Core qualification: Compulsory

General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Compulsory

 $\label{thm:condition} \textbf{General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory and the second seco$

General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program): Specialisation Energy and Environmental Engineering: Compulsory

General Engineering Science (English program): Specialisation Computer Science: Compulsory

General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory

General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program); Specialisation Process Engineering; Compulsory

General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory

 $General\ Engineering\ Science\ (English\ program, 7\ semester):\ Specialisation\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Compulsory\ Mechanical\ Engineering,\ Focus\ Mechatronics:\ Mechanical\ Engineering,\ M$

General Engineering Science (English program, 7 semester); Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences
Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory

General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory

Computational Science and Engineering: Core qualification: Compulsory

Logistics and Mobility: Core qualification: Compulsory

 ${\bf Mechanical\ Engineering:\ Core\ qualification:\ Compulsory}$

Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory

Technomathematics: Core qualification: Compulsory

Process Engineering: Core qualification: Compulsory



se L0880: Introduction to Mana	gement
Тур	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. 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
Literature	 Relevance of Controlling and selected Controlling methods Important aspects of Entrepreneurship projects Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008 Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003 Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006. Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001. Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008. Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005. Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008. Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Course L0882: Project Entrepreneu	rship
Тур	Problem-based Learning
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl
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 M0891: Informatics	for Process Engineers			
Courses				
		T	How fields	0.0
Title		Тур	Hrs/wk	CP
Informatics for Process Engineers (L0836 Informatics for Process Engineers (L0837		Lecture Recitation Section (small)	2	2
Numeric and Matlab (L0125))	Laboratory Course	2	2
Module Responsible	Dr. Marcus Venzke	Laboratory Course		2
Admission Requirements	None.			
Recommended Previous	Basic knowledge in using MS Windows.			
Knowledge	Sasion works and saing me vindous.			
Educational Objectives	After taking part successfully, students have reached the following lea	rning results		
Professional Competence	5,,,,	<u> </u>		
·	Students can describe procedural and object-oriented concepts.			
Personal 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): Specialisation Proc	ess Engineering: Elective Compuls	ory	
Curricula	General Engineering Science (German program, 7 semester): Special	lisation Energy and Enviromental E	ngineering: Elective Co	ompulsory
	General Engineering Science (German program, 7 semester): Special	lisation Process Engineering: Electi	ve Compulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compulso	ory		
	General Engineering Science (English program): Specialisation Proce	ess Engineering: Elective Compulso	ory	
	General Engineering Science (English program, 7 semester): Speciali	isation Energy and Enviromental Er	ngineering: Elective Co	mpulsory
	General Engineering Science (English program, 7 semester): Speciali	isation Process Engineering: Electiv	ve Compulsory	
	Process Engineering: Core qualification: Compulsory			



Course L0836: Informatics for Proc	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
Literature	Objects, classes Methods, properties Inheritance Basics of the language Java Sample application: Simulation of an electricity network 2D graphics Events and Controls 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: Tll 717 Cowell, John: Essential Java 2 fast. Springer Verlag, London, 1999. Bibliothek: Tll 942 Java SE 7 Documentation http://docs.oracle.com/javase/7/docs/ Java Platform, Standard Edition 7 API Specification http://docs.oracle.com/javase/7/docs/api/

Course L0837: Informatics for Process Engineers		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Marcus Venzke	
Language	DE	
Cycle	SoSe	
Content	In the lab, the content from the lecture is practiced and deepened with practical assignments. Every week one or two programming tasks are assigned. These are solved by the students on computers independently, coached by a tutor.	
Literature	Campione, Mary; Walrath, Kathy: The Java Tutorial - A practical guide for programmers. Addison-Wesley, Reading, Massachusets, 1998. Bibliothek: TII 978 Krüger, Guido; Hansen, Heiko: Handbuch der Java-Programmierung. 3. Auflage Addison-Wesley, 2002. http://www.javabuch.de/ Krüger, Guido: Go to Java 2. Addison-Wesley Verlag, Bonn, 1999. Bibliothek: TII 717 Cowell, John: Essential Java 2 fast. Springer Verlag, London, 1999. Bibliothek: TII 942 Java SE 7 Documentation http://docs.oracle.com/javase/7/docs/ Java Platform, Standard Edition 7 API Specification http://docs.oracle.com/javase/7/docs/api/	



Course L0125: Numeric and Matlab	
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Siegfried Rump, Weitere Mitarbeiter
Language	DE
Cycle	SoSe
Content	1. Programming in Matlab 2. Numerical methods for systems of nonlinear equations 3. Basics in computer arithmetic 4. Linear and nonlinear optimization 5. Condition of problems and algorithms 6. Verified numerical results with INTLAB
Literature	1. Moler, C., Numerical Computing with MATLAB, SIAM, 2004 2. The Math Works, Inc., MATLAB: The Language of Technical Computing, 2007 3. Rump, S. M., INTLAB: Interval Labority, http://www.ti3.tu-harburg.de 4. Highham, D. J.; Highham, N. J., MATLAB Guide, SIAM, 2005



Module M1274: Environme	ntal Technology			
Courses				
Title		Тур	Hrs/wk	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	Tundanonalo et morganio organio enembary and biology			
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
•	After taking part successionly, students have reached the follow	ing rearring results		
Professional Competence	NAViaba aban a a annula di an afabi a mandi ila dha a banda aban a anni in di annu	the learning days of improvement access officet also		
Knowledge	With the completion of this module the students acquire in-dep		•	•
	might occur from production processes, projects or construction			
	in dealing with different methods and instruments to assess e		its are able to estimate	the complexity of thes
	environmental processes as well as uncertainties and difficultie			
Skills	'			
	solutions for managing and mitigating environmental proble			
	independently and can apply the software programs OpenLCA		g the course the stude	nts have the competen
	to critically judge research results or other publications on envi	ronmental impacts.		
Personal Competence				
Social Competence	The students are able to discuss the various technical and sc	ientific tasks, both subject-specific and mu	ultidisciplinary. They ar	e able to develop join
	different solutions and to discuss their theoretical or practical			
	multi-layered issues of the environment protection and the co			
	raised and which helps to raise their awareness of their future s			
Autonomy	The students learn to research, process and present a scienti	fic topic independently. They are able to s	earn, out independent	coiontifio work. Thou or
Autonomy	solve an environmental problem in a business context and are		arry out independent	scientific work. They co
	solve an environmental problem in a basiness comoxi and are	able to judge results of other publications.		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Examination	Written exam			
Examination duration and scale	1 hour written exam			
Assignment for the Following		on Energy and Environmental Engineering	Compulsory	
Curricula	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program, 7 semester):			v.
	General Engineering Science (German program, 7 semester):			J
	General Engineering Science (German program, 7 semester):			
			cuve Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsor	•		
	Energy and Environmental Engineering: Core qualification: Co		ompulsory	
	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): S		•	,
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	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S	ppecialisation Bioprocess Engineering: Ele	cuve 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



Thesis

Module M-001: Bachelor Th	nesis
Courses	
Title	Typ Hrs/wk CP
Module Responsible	Professoren der TUHH
Admission Requirements	Troissorement Torrit
7.4	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. 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 them in a manner that is appropriate to the addressees. In doing so they can uphold their own assessments and viewpoints convincingly.
Autonomy	
national	 The students are capable of structuring an extensive work process in terms of time and of dealing with an issue within a specified time frame. The students are able to identify, open up, and connect knowledge and material necessary for working on a scientific problem. The students can apply the essential techniques of scientific work to research of their own.
Workload in Hours	Independent Study Time 360, Study Time in Lecture 0
Credit points	12
Examination	according to Subject Specific Regulations
Examination duration and scale	
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
	Process Engineering: Thesis: Compulsory