

Module Manual

Bachelor of Science

General Engineering Science (English program)

Cohort: Winter Term 2015

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Program description

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The Bachelor-program General Engineering Science (GES) starts with a broad, for all students binding fundamental engineering curricula. With begin of the 3rd Semester students have to choose one of the 9 fields of study, some of them with further specialisations. GES is designed as an intensive course of studies, with a higher workload than 180 credit points. The Bachelor degree in one of the fields of study enables a consecutive study of one of the corresponding Master studyies, of another technical or of an economic oriented Master study. Most of the modules in the 1st and the 2nd semester of GES are offered in English.

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Core qualification

Module M0701: Chemistry (GES)					
Courses					
Title			Тур	Hrs/wk	CP
	GES) I (L0467)		Lecture	2	2
	GES) I (L0478)		Recitation Section (large)	1	1
	GES) II (L0469)		Lecture	2	2
Chemistry (GES) II (L0479)		Recitation Section (large)	1	1
	Module Responsible	NN			
A	Admission Requirements	None			
	Recommended Previous	None			
	Knowledge				
	Educational Objectives	After taking part successfully, students have reached the followi	na learnina results		
P	rofessional Competence		3 3		
	Knowledge				
	Skills				
	Personal Competence				
	Social Competence				
	Autonomy				
	Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
	Credit points	6			
	Examination	Written exam			
Examir	nation duration and scale	120 min			
Assi	ignment for the Following	General Engineering Science (English program): Core qualification	tion: Compulsory		
	Curricula				
Course L0	467: 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					
Cycle	WiSe				
Content	- Structure of matter				
	- Periodic table				
	- Electronegativity				
	- Libelionegalivity				
	- Chemical bonds				
	Colid companyed and	alutiona			
	- Solid compounds and so	olutions			
	- Chemistry of water				

	- Chemisuy 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	1469: Chemistry (GES) II	
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload	Independent Study Time 32, Study Time in Lecture 28	
in Hours		
Lecturer	Dr. Christoph Wutz	
Language	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 M0736: Linear Alge	bra			
Courses				
Title		Тур	Hrs/wk	CP
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	School mathematics			
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ed the following learning results		
Professional Competence				
Skills	 Students can discuss logical connections l They know proof strategies and can reproof Students can model problems in linear alg applying established methods. Students are able to discover and verify fu 	inear algebra. They are able to explain them using app between these concepts. They are capable of illustratin duce them. webra with the help of the concepts studied in this course rther logical connections between the concepts studied elop and execute a suitable approach, and are able to o	g these connections w e. Moreover, they are control of the course.	apable of solving them b
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 128, Study Time in Lectu	ire 112		
Credit points	8			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	Computer Science: Core qualification: Compulsor	у		
Curricula	General Engineering Science (English program):	Core qualification: Compulsory		

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

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



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



Module M0745: Electrical E	ingineering 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				
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge Skills	 The students know the basic theory, relations and methods of a Kirchhoffs voltage and current laws, Ohm's law, methods to simplify and analyze direct current networks description of electric and magnetic fields by use of vec Basic material relations, Gauss's law, Ampère's law, induction law, Maxwell's equation in the integral form, concept and definition of resistance, capacitance and ir 	s, torial field quantities, nductance.	-	
	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 and inductance of simple geometric arrangements.			
Personal Competence				
Social Competence	Students are able to solve specific problems alone or in a group and to present the results accordingly. Students can explain concepts and on the basis of examples verify and deepen their understanding.			
Autonomy	Students are able to acquire particular knowledge using text other fields. The students develop perseverance to also solve r		ate, present and assoc	iate this knowledge wit
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 Curricula	General Engineering Science (English program): Core qualific	ation: Compulsory		

Course L0677: Electrical Engineering	ng l
Тур	Lecture
Hrs/wk	3
CP	5
Workload in Hours	Independent Study Time 108, Study Time in Lecture 42
Lecturer	Prof. Manfred Kasper
Language	EN
Cycle	WiSe
Content	 Basics of Resistive Circuits Simplifying Resistive Circuits Network Analysis The Electrostatic Field Stationary Currents in Conductive Media Electrostatic Field in Non-Conductive Media Static Magnetic Field 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 Engineerin	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	



Module M1081: Mechanics	I (GES)			
-				
Courses				
Title		Тур	Hrs/wk	CP
Mechanics I (GES) (L1373)		Lecture	2 3	3 3
Mechanics I (GES) (L1374)		Recitation Section (large)	3	3
Module Responsible	Prof. Radoslaw Iwankiewicz			
Admission Requirements	None			
Recommended Previous				
Knowledge	After the line of the state tendence is a state of the	ter la color de la color		
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	The primary purpose of the study of Statics is to develop the		-	
	structures, which are at rest (in equilibrium). Such a capacity is	s critical to the design of many structural or	engineering systems.	The particular objectives
	of this course are to:			
	1. Introduce the student to the basic principles required	to analyse the effects of forces applied to	o rigid bodies, structu	ral elements and simple
	structures in equilibrium;			
	2. Demonstrate sound techniques of constructing and solv	ving idealised mathematical models of real	engineering systems;	
	3. Promote the analytical and problem-solving skills requi	red to solve a wide variety of real engineer	ing problems effectivel	у.
Skills	At the end of this course the student is able to:			
	1. Apply the properties of two- and three-dimensional forc	e systems to the analysis of structural elem	ents and simple structu	ıres in equilibrium.
	 Isolate a body in equilibrium by drawing its free-body d 			
	3. Analyse the external effects of forces acting on a single	body or a system of bodies in two- and thr	ee-dimensional equilib	prium 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	on.		
	6. Determine mass centres and centroids of lines, areas a	nd volumes.		
Personal Competence				
Social Competence	Students can: - work in groups and report on the findings, -	develop joint solutions in mixed teams a	and present them to o	thers, - assess the team
,	collaboration and their own share in it.	•••		
Autonomy	Students are able to: - solve the problems independently with t	he help of hints, - assess their own strenath	ns and weaknesses. e.	g. with the aid of the mid
	term test.			0
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, fricti	on, trusses, beams.		
Assignment for the Following	General Engineering Science (English program): Core qualific	ation: Compulsory		
Curricula				

Course L1373: Mechanics I (GES)		
Тур	Lecture	
Hrs/wk		
CP	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
Physics-Lab for ET/ AIW/ GES (L0948)		Laboratory Course	1	2
Module Responsible	Dr. Alexander Petrov			
Admission Requirements	None			
Recommended Previous				
Knowledge	Calculus and linear algebra on high school level			
	Physics on high school level			
Educational Objectives	After taking part successfully, students have reached the fo	llowing learning results		
Professional Competence				
Knowledge	Students can explain fundamental topics and laws of physi	cs such as in the areas of mechanics, oscillation	ns,	
	waves, and optics.			
	Students can relate physics topics to technical problems.			
	Students can describe physical problems mathematically a	ind solve such problems within the framework o)†	
	their acquired mathematical expertise.			
	Students are able to write meaningful reports on experiment	nts and to discuss the results in a conclusive wa	iy.	
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 and lab course	PS.		
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 le		n typical exam questio	ons. Students are able to
	connect their knowledge with that acquired from other lectu	ires.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
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				

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



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

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



Module Responsible	Dagmar Richter
Admission Requirements	None
Recommended Previous	None
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The Non-technical Elective Study Area
	imparts skills that, in view of the TUHH's training profile, professional engineering studies require but are not able to cover fully. Self-reliance
	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
	by opting for specific competences and a competence level at the Bachelor's or Master's level. The teaching offerings are pooled in two di
	catalogues for nontechnical complementary courses.
	The Learning Architecture
	consists of a cross-disciplinarily study offering. The centrally designed teaching offering ensures that courses in the "non-technical department" foll
	specific profiling of TUHH degree courses.
	The learning architecture demands and trains independent educational planning as regards the individual development of competences. It also pr
	orientation knowledge in the form of "profiles"
	The subjects that can be studied in parallel throughout the student's entire study program - if need be, it can be studied in one to two semesters.
	of the adaptation problems that individuals commonly face in their first semesters after making the transition from school to university and in o
	encourage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters during the co
	studies.
	Teaching and Learning Arrangements
	provide for students, separated into B.Sc. and M.Sc., to learn with and from each other across semesters. The challenge of dealing with interdiscip
	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 studie
	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 commun 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 re in the practical examples used, in content topics that refer to different professional application contexts, and in the higher scientific and theoretical
	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 Bac
	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 spece
	sciences are subject to individual and socio-cultural interpretation and historicity,
	 Can communicate in a foreign language in a manner appropriate to the subject.
Skills	
	In selected sub-areas students can
	apply basic methods of the said scientific disciplines,
	• auestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specialist discipline,
	to handle simple questions in aforementioned scientific disciplines in a successful manner,
	 justify their decisions on forms of organization and application in practical questions in contexts that go beyond the technical relationship subject
	subject.
Personal Competence	
Social Competence	Personal Competences (Social Skills)
	Students will be able
	• to learn to callaborate in different manner
	 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 proson and data see proson and addresses of a particle of group statation in a manner appropriate to the decreases, to express themselves competently, in a culturally appropriate and gender-sensitive manner in the language of the country (as far as this
	focus would be chosen),
	 to evolvin pontechnical items to auditorium with technical background knowledge

• 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
Worklood in Hours	to organize themselves as an entrepreneurial subject country (as far as this study-focus would be chosen)
Credit points	6

Courses

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



Module M0671: Technical T	hermodynamics I			
Courses				
Title		Тур	Hrs/wk	CP
Technical Thermodynamics I (L0437)		Lecture	2	4
Technical Thermodynamics I (L0439)		Recitation Section (large)	1	1
Technical Thermodynamics I (L0441)	Prof. Gerhard Schmitz	Recitation Section (small)	1	1
Module Responsible				
Admission Requirements Recommended Previous	none			
Knowledge	Elementary knowledge in Mathematics and Mechanics			
	After taking part augeografully, atudanta have received the follow			
Educational Objectives	After taking part successfully, students have reached the follow	ving learning results		
Professional Competence				
Knowledge	Students are familiar with the laws of Thermodynamic. They	know the relation of the kinds of energy ac	cording to 1 st law of	Thermodynamic and are
	aware about the limits of energy conversions according to 2 nd	law of Thermodynamic. They are able to di	stinguish between sta	te variables and proces
	variables and know the meaning of different state variables I	ike temperature, enthalpy, entropy and also	the meaning of exer	gy and anergy. They ar
	able to draw the Carnot cycle in a Thermodynamic related dia	agram. They know the physical difference be	etween an ideal and a	real gas and are able t
	use the related equations of state. They know the meaning of a	a fundamental state of equation and know th	e basics of two phase	Thermodynamic.
Skills	Students are able to calculate the internal energy, the enthalp	y the kinetic and the potential energy as we	Il as work and heat fo	r simple change of state
Civilio Civilio	and to use this calculations for the Carnot cycle. They are ab			
	variables.	le lo calculate state vallables foi all'ideal a	nu ioi a real gas non	i ineasureu inerinai siat
	variables.			
Personal Competence	<u>-</u>			
Social Competence	The students are able to discuss in small groups and develop			
Autonomy	Students are able to define independently tasks, to get new kn	owledge from existing knowledge as well as	s to find ways to use th	ie 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 qualifi	cation: Compulsory		
Curricula	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Co	ompulsory		
	General Engineering Science (English program): Core qualific	cation: Compulsory		
	Computational Science and Engineering: Specialisation Engin	neering Sciences: Elective Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation Engineering Science: Ele	ctive Compulsory		
	Process Engineering: Core qualification: Compulsory			
	riocos Engineening. Oore qualification. Compuisoly			



Course L0437: Technical Thermody	namics I
Тур	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Gerhard Schmitz
Language	DE
Cycle	SoSe
Content	1. Introduction
	2. Fundamental terms
	3. Thermal Equilibrium and temperature
	3.1 Thermal equation of state
	4. First law
	4.1 Heat and work
	4.2 First law for closed systems
	4.3 First law for open systems
	4.4 Examples
	5. Equations of state and changes of state
	5.1 Changes of state
	5.2 Cycle processes
	6. Second law
	6.1 Carnot process
	6.2 Entropy
	6.3 Examples
	6.4 Exergy
	7. Thermodynamic properties of pure fluids
	7.1 Fundamental equations of Thermodynamics
	7.2 Thermodynamic potentials
	7.3 Calorific state variables for arbritary fluids
	7.4 state equations (van der Waals u.a.)
Literature	
	Schmitz, G.: Technische Thermodynamik, TuTech Verlag, Hamburg, 2009
	Baehr, H.D.; Kabelac, S.: Thermodynamik, 15. Auflage, Springer Verlag, Berlin 2012
	Potter, M.; Somerton, C.: Thermodynamics for Engineers, Mc GrawHill, 1993
	1

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

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



Module M0737: Mathematic				
would worst. wathematic	ai Anaiysis			
Courses				
Title		Тур	Hrs/wk	CP
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				
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ned the following learning results		
Professional Competence				
Knowledge Skills	 Students can name the basic concepts in Students can discuss logical connections They know proof strategies and can repro Students can model problems in analysis applying established methods. Students are able to discover and verify fully fully and the strategies and the	analysis. They are able to explain them using appropria between these concepts. They are capable of illustrati duce them. Is with the help of the concepts studied in this course rther logical connections between the concepts studied elop and execute a suitable approach, and are able to	ng these connections w Moreover, they are ca d in the course.	pable of solving them I
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 128, Study Time in Lectu	ure 112		
Credit points	8			
Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following	Computer Science: Core qualification: Compulso	ry		
Curricula	General Engineering Science (English program):	Core qualification: Compulsory		

Course L0647: Mathematical Analys	sia
	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 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 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	Prof. Frank Gronwald			
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	me dependent network theory and basi	c nonlinear circuit eler	ments. This includes, i
	particular:			
	transients,			
	 the use of complex numbers and phasors, 			
	the concept of impedance,			
		steady state sinusoidal circuit analysis,		
	 complex power and 3-phase systems, transformers 			
	 transformers, transfer function and filters, 			
	 the concept of resonance, 			
	 diodes and rectifiers, 			
	 bipolar transistors and operational amplifiers 			
Skills	The students are able to establish relations between time depen	dent currents and voltages in linear netw	orks. The students kno	w how to apply networ
	theory to analyze 3-phase systems, transformers, filter-like strue	ctures, and resonating networks. The stu	udents know to includ	e basic nonlinear circu
	elements, such as diodes, bipolar transistors, and operational an	plifiers, into the network analysis.		
Barranal Commetance				
Personal Competence	Studente ara able te colve encoifie probleme, alega avia a arcore	and to present the results associate the C	tudanta ann avalcia an	noopto and on the basi
Social Competence	Students are able to solve specific problems, alone or in a group.		uuenis can explain co	ncepts and, on the basi
	of examples and exercises, verify and deepen their understandin	y.		
Autonomy	Students are able to acquire particular knowledge using textboo	oks in a self-learning process, to integra	te, present, and assoc	iate this knowledge wit
	other fields. The students develop persistency to also solve more	complicated problems.		
We wild a set in the same				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6 Written even			
Examination Examination duration and scale	Written exam 120 minutes			
Assignment for the Following	General Engineering Science (English program): Core qualificati	on: Compulsory		
Curricula				

Course L0747: Electrical Engineerin	ng II
Тур	Lecture
Hrs/wk	3
CP	5
Workload in Hours	Independent Study Time 108, Study Time in Lecture 42
Lecturer	Prof. Frank Gronwald
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 Engineerin	ng II
Тур	Recitation Section (small)
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Frank Gronwald
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 Manual B. Sc. "General Engineering Science (English program)"



Tripic Typ Hrawk CP Modularscall (IGES) (1447) Lacture 2 3 Modular Respondib Prof. Radoslaw banklewic: 2 3 Admission Reguirements More 2 3 Education Section (target) 2 3 Professional Comprise None 2 3 Education Comprise Mare taking part successfully, students have reached the following learning results 2 3 Professional Comprise The primary purpose of the study of Mechanics of Materials/Solids is to develop the capacity to predict the effects of forces on elastic bodies, structural efferencies of this course are to : 1 1 Initiation of the student to the basic principles required to analyse the effects of forces applied to elastic bodies, structural efferencies of structural efferencies of structural efferencies of structural efferencies applied to elastic bodies, structural efferencies applied to the analyse the effects of forces applied to elastic bodies, structural effectively. State Althre effective of this course the student shuld be able to: 1 Determine thermal structures in reguirburne. 2 Determine thermal structures in reguirburne. 2 State Determine thermal structures in reguirburne to structural efferestructural efferestrestruct	Courses				
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Admission Requirements None Recommended Previous Knowledge Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence The primary purpose of the study of Mechanics of MaterialsSolids is to develop the capacity to predict the effects of forces on elastic bodies, structure all engineering systems. The particular objective of this course are to:: 1. Introduce the student to the badic principles required to analyse the effects of forces applied to elastic bodies, structural elements and simple structures, which are at rest (in equilibrium). Such a capacity is critical to the design of many structural or engineering systems; 2. Demonstrate cound bechniques of constructing and solving (dealleed mathematical models of real engineering systems; 3. Promote the analytical and problem solving skills required to solve a wide variety of real engineering systems; 3. Promote the student should be able to: 1. Determine hear stresses 2. Determine hear stresses and the angle of twist due to brain of a circular shaft. 3. Determine hear stresses as well as grincipal axes and moments of inertia. 4. Analyse tablify of equilibrium of simple systems and bucking of elastic columns. 5. Determine and their stresses as well as detections due to bending. 6.					
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Knowledp The primary purpose of the sludy of Mechanics of Materials/Solids is to develop the capacity to predict the effects of forces on elastic bodies, structural elements and simple structures, which are at test (in equilibrium). Such a capacity is critical to the design of many structural elements and simple structures, which are at test (in equilibrium). Such a capacity is critical to the design of many structural elements and simple structures in equilibrium. Introduce the student to the basic principles required to analyse the effects of forces applied to elastic bodies, structural elements and simple structures in equilibrium: Demonstrate sound techniques of constructing and solving idealised mathematical models of real engineering systems; Promote the analytical and problem-solving sills required to solve a wide variety of real engineering problems effectively. Skills Athe end of this course the student should be able to:					
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Personal Competence Sudemis car: -work in groups and report on the findings, - develop joint solutions in mixed teams and present them to others, - assess the team of classic constructions in diverting in the classic constructions in mixed teams and present them to others, - assess the team of classic constructions of solutions in mixed teams and present them to others, - assess the team of the same team of the same team of the solutions of solutions in mixed teams and present them to others, - assess the team of the same team of the same team of the solutions of solutions in mixed teams and present them to others, - assess the team of the same team of the same team of the same team of the solution of the team of the same team of the solution of the team of the same teams of the same team of the same team of the same teams of the same teams of the same team of the same teams of the same team of the same teams of the same team of the same teams of the same team of the same team of the same team of the same team of the same teams of the same team of the same team of the same teams of the same team of the same team of the same teams of the same teams of the same team of the same teams of the same	Knowledge				
1. Introduce the student to the basic principles required to analyse the effects of forces applied to elastic bodies, structural elements and similar structures in equilibrium; 2. Demonstrate sound techniques of constructing and solving idealised mathematical models of real engineering systems; 3. Promote the analytical and problem-solving skills required to solve a wide variey of real engineering problems effectively. Skills At the end of this course the student should be able to: 1. Determine average normal and shear stresses. Determine themal stresses and the angle of twist due to torsion of a circular shaft. 3. Determine thermal stresses in rods. A nalyse talcally indelerminate rods and shafts. 5. Determine normal and shear stresses as well as defections due to bending. A nalyse plane state of stress (stress transformation). 8. Analyse plane state of stress (stress transformation). A nalyse plane state of stress (stress transformation). 9. Determine displacements and solve statically indeterminate problems with the aid of energy (Castigliano's) method. 1. 1. Personal Competence Sudents can: -work in groups and report on the findings, - develop joint solutions in mixed teams and present them to others, - assess the team olaboration and their own share in it. 9. Determine displacements in dependently with the help of hints, - assess their own strengths and weaknesses, e.g. with the help of hints, - assess their own strengths and weaknesses, e.g. with the help of hints, - assess their own strengths and weaknes			. Such a capacity is childen to the design	of many suddurar of	singineering systems. In
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methods.	Examination	Written exam			
	Examination duration and scale		loading, torsion, bending, stress transfo	rmation, moments of	inertia, buckling, ener
Assignment for the Following General Engineering Science (English program): Core qualification: Compulsory		methods.			
	Assignment for the Following	General Engineering Science (English program): Core qualificat	on: 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
	COURSE CONTENTS: 1. Normal and shear stress, average normal and shear stress. 2. Normal and shear strain. 3. Axial loading: elastic deformation and statically indeterminate problems. Thermal stresses. Statically indeterminate axially loaded rods. 4. Area moments of inertia. 5. Torsion of a circular shaft shear strain and stress, the angle of twist. 6. Bending. Pure and symmetric bending: normal strain and stress. Deflection of beams: elastic curve. Statically indeterminate beams. 7. Un-symmetric bending. 8. Bending with a transverse shear: shear stresses in beams. Shear flow in thin-walled members, shear center. 9. Plane-stress transformation. 10. Stability of equilibrium and buckling of elastic columns. 11. Elastic strain energy and energy methods: Castigliano's theorem – determination of displacements and statically indeterminate problems. 12. '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
	3. J.L. Meriam and L.G. Kraige, Engineering Mechanics, Vol. 1, Statics, John Wiley & Sons, SI Version, 4 th Edition

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 M1121: Programmir	ng in C				
Courses		T	Live fords	0.5	
itle		Typ	Hrs/wk	CP	
Programming in C (L0083) Programming in C (L1488)		Lecture Laboratory Course	1	1	
Module Responsible	Prof. Siegfried Rump		•	•	
~	None				
	Elementary PC handling skills				
Knowledge	Elementary mathematical skills				
Educational Objectives	After taking part successfully, students have reached the follo	owing learning results			
Professional Competence					
Knowledge	The students know by heart the basic syntax of C programmi purpose.	ng as well as its meaning, intent and			
	They know the fundamental components and principles of el	ementary procedural programming			
	based on C programming and can explain them:				
	- hasis data tupos (integers, flasting point numbers, characte	~~)			
	 basic data types (integers, floating point numbers, characte advanced data types (pointers, arrays, strings, composed d 				
	 operators (arithmetical operations, logical operations, bit op 				
	 control flow (choice, loops, jumps, conditional compilation) 				
	• functions and macros				
	important standard libraries and functions				
	• recursion				
	Iinked lists				
	The students are prepared for continuing programming lectu	res like object oriented programming in C++.			
Skills	The students know how to use an integrated development er so that they can write, store, compile and execute C program				
	Using their knowledge they are able to read and understand	given C Programs.			
	They can solve simple algorithmic problems on their own an in C language.	d can model and program their solutions			
	The students are able to solve selected exercises from other mechanics, electrical engineering or physics with the aid of s				
Personal Competence					
-	The students are able to work in small teams to solve given a programming errors and to present their results.	weekly tasks, to identify and analyze			
	They are able to explain simple phenomena to each other di	rectly at the PC.			
Autonomy	The students prepare themselves using the given teaching r programming exercises on their own.	naterial and solve the given			
	Additionally, they write small C programs to understand and gain a certain programming experience.	check addressed issues and also to			
	For details beyond the seens of the least we the students info	m thomsolves using the stated			
	For details beyond the scope of the lecture the students infor literature and / or by supplementary own research.	in menserves using the stated			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28				
	2				
	Homework				
Examination duration and scale	1-2 coding tasks weekly				
Assignment for the Following	General Engineering Science (German program): Core qual	ification: Compulsory			-



Course L0083: Programming in C	
Тур	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Siegfried Rump, Weitere Mitarbeiter
Language	DE/EN
Cycle	SoSe
Content	C-Programming:
	1. basic data types (integers, floating point numbers, characters, boolean values)
	2. 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)
	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
Literature	Kernighan, Brian W (Ritchie, Dennis M.;)
	The C programming language
	ISBN: 9780131103702
	Upper Saddle River, NJ [u.a.] : Prentice Hall PTR, 2009
	Sedgewick, Robert
	Algorithms in C
	ISBN: 0201316633
	Reading, Mass. [u.a.] : Addison-Wesley, 2007
	Kaiser, Ulrich (Kecher, Christoph.;)
	C/C++: Von den Grundlagen zur professionellen Programmierung
	ISBN: 9783898428392
	Bonn : Galileo Press, 2010
	Wolf, Jürgen
	C von A bis Z : das umfassende Handbuch
	ISBN: 3836214113
	Bonn : Galileo Press, 2009

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



Module M0594: Fundament	als of Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Mechanical Engineering Design (L0258)		Lecture	2	3
Fundamentals of Mechanical Engineering I	Design (L0259)	Recitation Section (large)	2	3
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	Basic knowledge about mechanics and production engine	oring		
Knowledge	 Basic knowledge about mechanics and production engine Internship (Stage I Practical) 	enig		
	• Internship (Stage (Fractical)			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	explain basic working principles and functions of machine	elements		
	 explain requirements, selection criteria, application scen 		machine elements. in	dicate the background of
	dimensioning calculations.			3
Skills	After passing the module, students are able to:			
	 accomplich dimensioning calculations of covered machine 	alements		
	 accomplish dimensioning calculations of covered machine elements, transfer knowledge learned in the module to new requirements and tasks (problem solving skills), 			
	 recognize the content of technical drawings and schematic sketches, 			
	 technically evaluate basic designs. 			
Personal Competence				
Social Competence	Students are able to discuss technical information in the lecture supported by activating methods.			
Autonomy				
	 Students are able to independently deepen their acquired knowledge in exercises. Students are able to acquire additional knowledge and to receptivilate people understand content or a buryling the video receptings of the second s		video recordings of the	
	 Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of the lectures. 			
Workload in Hours	Independent Study Time 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 qualificati			
Curricula	Energy and Environmental Engineering: Core qualification: Comp	•		
	General Engineering Science (English program): Core qualification	on: Compulsory		
	Logistics and Mobility: Core qualification: Compulsory			
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Core qualification: Elective Compulsory			
	reentenduremanes. Gore quamication. Elective Compuisory			



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 design Introduction to the following machine elements Screws Shaft-hub joints Rolling contact bearings Welding / adhesive / solder joints Springs Axes & shafts Presentation of technical objects (technical drawing)
	Exercise Calculation methods for dimensioning the following machine elements: Screws Shaft-hub joints Rolling contact bearings Welding / adhesive / solder joints Springs Axis & shafts
Literature	 Dubbel, Taschenbuch 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



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, Mec	hanics and Technical Thermodynamics I			
Knowledge					
Educational Objectives	After taking part successfully, students have	reached the following learning results			
Professional Competence					
Knowledge	Students are familiar with different cycle prod	cesses like Joule, Otto, Diesel, Stirling, Seiliger and Clausi	ius-Rankine. They are able	e to derive energetic ar	
	exergetic efficiencies and know the influence	e different factors. They know the difference between anti	clockwise and clockwise c	ycles (heat-power cycl	
	cooling cycle). They have increased knowle	edge of steam cycles and are able to draw the different c	cycles in Thermodynamics	related diagrams. The	
		f humid air processes and are able to perform simple com			
		efinition of the speed of sound and know about a Laval no			
		· · · · · · · · · · · · · · · · · · ·			
Skille	Students are able to use thermodynamic la	ws for the design of technical processes. Especially they	are able to formulate ener	ray everay- and entror	
Skills	s Students are able to use thermodynamic laws for the design of technical processes. Especially they are able to formulate energy, exergy- and entropy balances and by this to optimise technical processes. They are able to perform simple safety calculations in regard to an outflowing gas from a tank.				
			alions in regard to an out	nowing gas norn a tar	
	They are able to transform a verbal formulate	ed message into an abstract formal procedure.			
Personal Competence					
Social Competence	The students are able to discuss in small gro	ups and develop an approach.			
Autonomy	Studente are able to define independently to	uska to got now knowledge from existing knowledge as we	I as to find ways to use th	· · · · · · · · · · · · · · · · · · ·	
Autonomy	Students are able to define independently ta	Students are able to define independently tasks, to get new knowledge from existing knowledge as well as to find ways to use the knowledge in practice			
				e knowledge in practice	
				e knowledge in practice	
				e knowledge in practic	
				e knowledge in practic	
Workload in Hours	Independent Study Time 124, Study Time in	Lecture 56		e knowledge in practic	
Workload in Hours Credit points	Independent Study Time 124, Study Time in 6	Lecture 56		e knowledge in practic	
		Lecture 56		e knowledge in practic	
Credit points	6	Lecture 56		e knowledge in practic	
Credit points Examination	6 Written exam			e knowledge in practic	
Credit points Examination Examination duration and scale	6 Written exam 90 min General Engineering Science (German prog			e knowledge in practic	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 min General Engineering Science (German prog	ram): Core qualification: Compulsory ram, 7 semester): Core qualification: Compulsory		e knowledge in practic	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 min General Engineering Science (German prog General Engineering Science (German prog	ram): Core qualification: Compulsory ram, 7 semester): Core qualification: Compulsory Compulsory		e knowledge in practic	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 min General Engineering Science (German prog General Engineering Science (German prog Bioprocess Engineering: Core qualification:	yram): Core qualification: Compulsory yram, 7 semester): Core qualification: Compulsory Compulsory re qualification: Compulsory		e knowledge in practic	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 min General Engineering Science (German prog General Engineering Science (German prog Bioprocess Engineering: Core qualification: Energy and Environmental Engineering: Con General Engineering Science (English prog	yram): Core qualification: Compulsory yram, 7 semester): Core qualification: Compulsory Compulsory re qualification: Compulsory ram): Core qualification: Compulsory		e knowledge in practic	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 min General Engineering Science (German prog General Engineering Science (German prog Bioprocess Engineering: Core qualification: Energy and Environmental Engineering: Con General Engineering Science (English prog General Engineering Science (English prog	rram): Core qualification: Compulsory rram, 7 semester): Core qualification: Compulsory Compulsory re qualification: Compulsory ram): Core qualification: Compulsory ram, 7 semester): Core qualification: Compulsory		e knowledge in practic	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 min General Engineering Science (German prog General Engineering Science (German prog Bioprocess Engineering: Core qualification: Energy and Environmental Engineering: Cor General Engineering Science (English prog General Engineering Science (English prog Computational Science and Engineering: Sp	gram): Core qualification: Compulsory gram, 7 semester): Core qualification: Compulsory Compulsory re qualification: Compulsory ram): Core qualification: Compulsory ram, 7 semester): Core qualification: Compulsory pecialisation Engineering Sciences: Elective Compulsory		e knowledge in practic	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 min General Engineering Science (German prog General Engineering Science (German prog Bioprocess Engineering: Core qualification: Energy and Environmental Engineering: Cor General Engineering Science (English prog General Engineering Science (English prog Computational Science and Engineering: Sp Mechanical Engineering: Core qualification:	rram): Core qualification: Compulsory rram, 7 semester): Core qualification: Compulsory Compulsory re qualification: Compulsory rram): Core qualification: Compulsory ram, 7 semester): Core qualification: Compulsory pecialisation Engineering Sciences: Elective Compulsory Compulsory		e knowledge in practic	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 min General Engineering Science (German prog General Engineering Science (German prog Bioprocess Engineering: Core qualification: Energy and Environmental Engineering: Cor General Engineering Science (English prog General Engineering Science (English prog Computational Science and Engineering: Sp Mechanical Engineering: Core qualification: Mechatronics: Core qualification: Compulsion	gram): Core qualification: Compulsory gram, 7 semester): Core qualification: Compulsory Compulsory re qualification: Compulsory ram): Core qualification: Compulsory ram, 7 semester): Core qualification: Compulsory pecialisation Engineering Sciences: Elective Compulsory Compulsory ry		e knowledge in practic	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 min General Engineering Science (German prog General Engineering Science (German prog Bioprocess Engineering: Core qualification: Energy and Environmental Engineering: Cor General Engineering Science (English prog General Engineering Science (English prog Computational Science and Engineering: Sp Mechanical Engineering: Core qualification: Mechatronics: Core qualification: Compulsion Technomathematics: Specialisation III. Engin	gram): Core qualification: Compulsory gram, 7 semester): Core qualification: Compulsory Compulsory re qualification: Compulsory ram): Core qualification: Compulsory ram, 7 semester): Core qualification: Compulsory pecialisation Engineering Sciences: Elective Compulsory Compulsory ry neering Science: Elective Compulsory		e knowledge in practic	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 min General Engineering Science (German prog General Engineering Science (German prog Bioprocess Engineering: Core qualification: Energy and Environmental Engineering: Cor General Engineering Science (English prog General Engineering Science (English prog Computational Science and Engineering: Sp Mechanical Engineering: Core qualification: Mechatronics: Core qualification: Compulsion	gram): Core qualification: Compulsory gram, 7 semester): Core qualification: Compulsory Compulsory re qualification: Compulsory ram): Core qualification: Compulsory ram, 7 semester): Core qualification: Compulsory pecialisation Engineering Sciences: Elective Compulsory Compulsory ry neering Science: Elective Compulsory ctive Compulsory		e knowledge in practic	



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 M1105: Mechanics	III (GES)			
Courses				
Title .		Тур	Hrs/wk	CP
Mechanics III (GES) (L1421)		Lecture	3	3
Mechanics III (GES) (L1420)		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	learning results		
Professional Competence				
	The science of the state of Masher in 11/71 is Online t		the state of the terms of the	1
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 a			
	motions, necessary for the analysis and design of moving machin	ne parts, different machinery, vehicles,	aircratt, spacecratt, au	itomatic control syster
	etc. The particular objectives of this course are to:			
	1. Determine the hydrostatic forces acting on different objects			
	 Analyse stability of floating bodies. 	•		
		nt reference quaterna		
	3. Analyse the kinematics and kinetics of a particle in differe			
	4. Analyse the motion of the system of particles and forces ac			
	5. Analyse the plane motion of a rigid body (simple mechanis	m) and forces acting on it.		
	Analyse the three-dimensional motion of a rigid body and feedback	prces acting on it.		
Skills	At the end of this course the student should be able to:			
	 Solve the equilibrium problems with account for hydrostatic Analyse stability of simple floating bodies. 	pressure forces.		
	3. Calculate the velocity and acceleration of a particle in different re	eference systems.		
	• 4. Derive and solve the equation of motion of a particle in d	ifferent reference systems.		
	5. Analyse the motion of the system of particles and forces acting of	on it with the aid of work-energy and im	pulse-momentum relat	ionships,
	6. Calculate the instantaneous linear and angular velocities and a			
	7. Derive and solve the equations of a plane motion of a rigid body			
	 8. Apply work-energy and impulse-momentum relationships to ana 9. Calculate the instantaneous linear and angular velocities and a 		motion of a rigid body	
	10. Derive the equations of a motion of a three-dimensional motion			
	11. Apply in three-dimensional kinematics and kinetics of rigid boo		matrix methods.	
Dorocnal Competence				
Personal Competence				
Social Competence	Students can: - work in groups and report on the findings, - dev	velop joint solutions in mixed teams a	and present them to o	thers, - assess the tea
	collaboration and their share in it.			
Autonomy	Students are able to: -solve the problems independently with the h	elp of hints, - assess their own strengt	ns and weaknesses, e.	g. with the aid of the m
	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 fl	nating vessels. Kinematics of particle	of plane and 2D ricid b	od v Kinetice of portio
LAATIMATION ON ANON AND SCALE		0	or prarre and 3D rigid C	ou,y. Mileucs of partic
	system of particles, of plane and 3D rigid body. Vector and matrix a	-		
Assignment for the Following	General Engineering Science (English program): Core qualificatio	1 2		
Curricula	General Engineering Science (English program, 7 semester): Core	1 1 5		
	Computational Science and Engineering: Specialisation Engineer	ing 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	
	1. Kinematics of a particle. Plane curvilinear motion: rectangular coordinates, normal and tangential coordinates, polar coordinates. Space curvilinear motion.	
	2. Constrained motion of connected particles.	
	3. Plane kinematics of a rigid body.	
	4. Relative (compound) motion.	
	5. Three-dimensional kinematics of a rigid body.	
	KINETICS	
	1. 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	



	Engineering			
Courses				
ïtle		Тур	Hrs/wk	CP
computer Engineering (L0321)		Lecture	3	4
Computer Engineering (L0324)		Recitation Section (small)	1	2
Module Responsible	Prof. Heiko Falk			
Admission Requirements	None			
Recommended Previous	Basic knowledge in electrical engineering			
Knowledge	The successful completion of the labs will be honored during the evaluati	on of the module's examination a	ccording to the followi	na rules:
	······································			
	1. Upon a passed module examination, the student is granted a		arks due to the succes	ssful labs, such that
	examination's marks are lifted by 0,3 or 0,4, respectively, up to the 2. The improvement of the grade 5,0 up to 4,3 and of 4,3 up to 4,0 is			
	2. The improvement of the grade 5,0 up to 4,5 and of 4,5 up to 4,0 is	not possible.		
Educational Objectives	After taking part successfully, students have reached the following learning	ng results		
Professional Competence				
Knowledge	This module deals with the foundations of the functionality of computin	g systems. It covers the layers f	rom the assembly-leve	el programming down
	gates. The module includes the following topics:			
	Introduction			
	Combinational logic: Gates, Boolean algebra, Boolean functions,	hardware synthesis, combination	al networks	
	Sequential logic: Flip-flops, automata, systematic hardware design	n		
	Technological foundations			
	Computer arithmetic: Integer addition, subtraction, multiplication a			
	Basics of computer architecture: Programming models, MIPS sing	le-cycle architecture, pipelining		
	Memories: Memory hierarchies, SRAM, DRAM, caches			
	 Input/output: I/O from the perspective of the CPU, principles of pas 	sing data, point-to-point connecti	ons, busses	
Skills	The students perceive computer systems from the architect's perspec	tive, i.e., they identify the interr	nal structure and the	physical composition
	computer systems. The students can analyze, how highly specific and	I individual computers can be b	ouilt based on a colle	ction of few and sim
	components. They are able to distinguish between and to explain the distinguish between and to explain the distinguish between and to explain the distinguish between and the explain the distinguish between	fferent abstraction layers of today	's computing systems	 from gates and circ
	up to complete processors.			
	After successful completion of the module, the students are able to judge	e the interdependencies betweer	n a physical computer	system and the softw
	executed on it. In particular, they shall understand the consequences that	at the execution of software has o	on the hardware-centri	c abstraction layers f
	the assembly language down to gates. This way, they will be enabled to	evaluate the impact that these lo	w abstraction levels ha	ive 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 pre	esent the results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific literature and t	o associate this knowledge with o	other classes.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
	Written exam			
Examination				
Examination Examination duration and scale	90 minutes, contents of course and labs			
	90 minutes, contents of course and labs General Engineering Science (German program): Core qualification: Con	npulsory		
Examination duration and scale			ory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con	tion Computer Science: Compuls	-	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con 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 tion Bioprocess Engineering: Co tion Naval Architecture: Compuls	mpulsory ory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con 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: Computer tion Bioprocess Engineering: Co tion Naval Architecture: Compuls tion Civil Engineering: Compulso	mpulsory ory ıry	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Computer tion Bioprocess Engineering: Co- tion Naval Architecture: Compuls tion Civil Engineering: Compulso tion Electrical Engineering: Comp	mpulsory ory ry pulsory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Compute tion Bioprocess Engineering: Co- tion Naval Architecture: Compuls tion Civil Engineering: Compulso tion Electrical Engineering: Com tion Biomedical Engineering: Co	mpulsory ory iry oulsory mpulsory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Compute tion Bioprocess Engineering: Co- tion Naval Architecture: Compuls tion Civil Engineering: Compulso tion Electrical Engineering: Com tion Biomedical Engineering: Co tion Energy and Enviromental En	mpulsory ory iry pulsory mpulsory gineering: Compulsor	y
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Compute tion Bioprocess Engineering: Co- tion Naval Architecture: Compute tion Civil Engineering: Compute tion Electrical Engineering: Comp tion Biomedical Engineering: Co tion Energy and Enviromental En- tion Process Engineering: Comp	mpulsory ory iry poulsory mpulsory igineering: Compulsor ulsory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Compute tion Bioprocess Engineering: Co- tion Naval Architecture: Compute tion Civil Engineering: Compute tion Electrical Engineering: Comp tion Biomedical Engineering: Co tion Energy and Enviromental En- tion Process Engineering: Comp tion Mechanical Engineering, Fo	mpulsory ory iry poulsory igineering: Compulsor ulsory cus Mechatronics: Con	npulsory
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Compute tion Bioprocess Engineering: Co- tion Naval Architecture: Compute tion Civil Engineering: Compute tion Electrical Engineering: Comp tion Biomedical Engineering: Co tion Energy and Enviromental En- tion Process Engineering: Comp tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo-	mpulsory ory iry poulsory igineering: Compulsor ulsory cus Mechatronics: Con cus Biomechanics: Con	npulsory mpulsory
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Compuls tion Bioprocess Engineering: Co- tion Naval Architecture: Compuls tion Civil Engineering: Compulse tion Electrical Engineering: Comp tion Biomedical Engineering: Comp tion Energy and Enviromental En- tion Process Engineering: Comp tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo-	mpulsory ory iry poulsory mpulsory gineering: Compulsor ulsory cus Mechatronics: Con cus Biomechanics: Co cus Aircraft Systems En	npulsory mpulsory ngineering: Compuls
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Compuls tion Bioprocess Engineering: Co- tion Naval Architecture: Compuls tion Civil Engineering: Compulse tion Electrical Engineering: Comp tion Biomedical Engineering: Comp tion Energy and Enviromental En- tion Process Engineering: Comp tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo-	mpulsory ory iry poulsory mpulsory gineering: Compulsor ulsory cus Mechatronics: Con cus Biomechanics: Co cus Aircraft Systems En	npulsory mpulsory ngineering: Compuls
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Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Compute tion Bioprocess Engineering: Co- tion Naval Architecture: Compute tion Civil Engineering: Compute tion Electrical Engineering: Comp tion Biomedical Engineering: Comp tion Energy and Enviromental En- tion Process Engineering: Comp tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering attion Mechanical Engineering lisation Mechanical Engineering	mpulsory ory ry pulsory mpulsory ulsory cus Mechatronics: Con cus Biomechanics: Co cus Aircraft Systems Er g, Focus Materials in I, Focus Theoretical M	npulsory mpulsory ngineering: Compuls Engineering Scient Mechanical Engineer
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Compute tion Bioprocess Engineering: Co- tion Naval Architecture: Compute tion Civil Engineering: Compute tion Electrical Engineering: Comp tion Biomedical Engineering: Comp tion Energy and Enviromental En- tion Process Engineering: Comp tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering attion Mechanical Engineering lisation Mechanical Engineering	mpulsory ory ry pulsory mpulsory ulsory cus Mechatronics: Con cus Biomechanics: Co cus Aircraft Systems Er g, Focus Materials in I, Focus Theoretical M	npulsory mpulsory ngineering: Compuls Engineering Scient Mechanical Engineer
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Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Speciali Compulsory General Engineering Science (German program, 7 semester): Speciali Compulsory General Engineering Science (German program, 7 semester): Specialisa	tion Computer Science: Compuls tion Bioprocess Engineering: Co- tion Naval Architecture: Compulso tion Civil Engineering: Compulso tion Electrical Engineering: Comp tion Biomedical Engineering: Co- tion Energy and Enviromental En- tion Process Engineering: Comp tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering lisation Mechanical Engineering sation Mechanical Engineering	mpulsory ory ry pulsory mpulsory ulsory cus Mechatronics: Con cus Biomechanics: Co cus Aircraft Systems Er g, Focus Materials in I, Focus Theoretical M Focus Product Devel	npulsory mpulsory ngineering: Compulse Engineering Sciend Mechanical Engineer opment and Product
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa Compulsory	tion Computer Science: Compuls tion Bioprocess Engineering: Co- tion Naval Architecture: Compulso tion Civil Engineering: Compulso tion Electrical Engineering: Comp tion Biomedical Engineering: Co- tion Energy and Enviromental En- tion Process Engineering: Comp tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering lisation Mechanical Engineering sation Mechanical Engineering	mpulsory ory ry pulsory mpulsory ulsory cus Mechatronics: Con cus Biomechanics: Co cus Aircraft Systems Er g, Focus Materials in I, Focus Theoretical M Focus Product Devel	npulsory mpulsory ngineering: Compuls Engineering Scient Mechanical Engineer opment and Product
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Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Com General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa Computer Science: Core qualification: Compulsory Electrical Engineering Science (English program): Core qualification: Com	tion Computer Science: Compuls tion Bioprocess Engineering: Co- tion Naval Architecture: Compulso tion Civil Engineering: Computer tion Electrical Engineering: Comp tion Biomedical Engineering: Comp tion Energy and Enviromental En- tion Process Engineering: Comp tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering lisation Mechanical Engineering sation Mechanical Engineering, tion Mechanical Engineering, sation Mechanical Engineering, tion Mechanical Engineering, Fo-	mpulsory ory iry pulsory igineering: Compulsor ulsory cus Mechatronics: Con cus Biomechanics: Co cus Aircraft Systems Er g, Focus Materials in I, Focus Theoretical M Focus Product Devel- cus Energy Systems: C	npulsory mpulsory ngineering: Compuls Engineering Scient Mechanical Engineer opment and Product
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Com General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa Computer Science: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory	tion Computer Science: Compuls tion Bioprocess Engineering: Co- tion Naval Architecture: Compulso tion Civil Engineering: Compulso tion Electrical Engineering: Comp tion Biomedical Engineering: Comp tion Energy and Enviromental En- tion Process Engineering: Comp tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering lisation Mechanical Engineering sation Mechanical Engineering, tion Mechanical Engineering, sation Mechanical Engineering, tion Mechanical Engineering, sation Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo-	mpulsory ory iry pulsory igineering: Compulsor ulsory cus Mechatronics: Con cus Biomechanics: Co cus Aircraft Systems Er g, Focus Materials in I, Focus Theoretical M Focus Product Devel cus Energy Systems: C	npulsory mpulsory ngineering: Compuls Engineering Scient Mechanical Engineer opment and Product
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Com General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa Computer Science: Core qualification: Compulsory Electrical Engineering Science (English program): Core qualification: Corr General Engineering Science (English program, 7 semester): Specialisa	tion Computer Science: Compuls tion Bioprocess Engineering: Co- tion Naval Architecture: Compulso tion Civil Engineering: Computer tion Electrical Engineering: Computer tion Biomedical Engineering: Computer tion Energy and Enviromental En- tion Process Engineering: Computer tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering sation Mechanical Engineering sation Mechanical Engineering, tion Mechanical Engineering, sation Mechanical Engineering, tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo-	mpulsory ory ry pulsory mpulsory ulsory cus Mechatronics: Con cus Biomechanics: Co cus Aircraft Systems Er g, Focus Materials in I, Focus Theoretical M Focus Product Devel cus Energy Systems: C	npulsory mpulsory ngineering: Compulse Engineering Sciend Mechanical Engineer opment and Product
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Com General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (German program, 7 semester): Specialisa Computer Science: Core qualification: Compulsory Electrical Engineering Science (German program, 7 semester): Specialisa Computer Science: Core qualification: Compulsory General Engineering Science (English program): Core qualification: Corr General Engineering Science (English program, 7 semester): Specialisat General Engineering Science (English program, 7 semester): Specialisat	tion Computer Science: Compuls tion Bioprocess Engineering: Co- tion Naval Architecture: Compulso tion Civil Engineering: Computer tion Electrical Engineering: Computer tion Biomedical Engineering: Computer tion Energy and Enviromental En- tion Process Engineering: Computer tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo- tion Mechanical Engineering sation Mechanical Engineering sation Mechanical Engineering, tion Mechanical Engineering, sation Mechanical Engineering, tion Mechanical Engineering, tion Mechanical Engineering, Fo- tion Mechanical Engineering, Fo-	mpulsory ory rry pulsory mpulsory igineering: Compulsor ulsory cus Mechatronics: Con cus Biomechanics: Con cus Biomechanics: Con cus Aircraft Systems Er g, Focus Materials in h, Focus Theoretical M Focus Product Devel cus Energy Systems: C	npulsory mpulsory ngineering: Compuls Engineering Scien Mechanical Engineer opment and Product
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Core qualification: Con General Engineering Science (German program, 7 semester): Specialisa General Engineering Science (German program, 7 semester): Specialisa Compulsory General Engineering Science (English program, 7 semester): Specialisa Computer Science: Core qualification: Compulsory Electrical Engineering Science (English program, 7 semester): Specialisat General Engineering Science (English program, 7 semester): Specialisat General Engineering Science (English program, 7 semester): Specialisat	tion Computer Science: Compuls tion Computer Science: Compuls tion Naval Architecture: Compuls tion Civil Engineering: Com tion Electrical Engineering: Com tion Biomedical Engineering: Com tion Energy and Enviromental En- tion Process Engineering: Compu- tion Mechanical Engineering, Fo- tion Mechanical Engineering, Sation Mechanical Engineering sation Mechanical Engineering, sation Mechanical Engineering, tion Mechanical Engineering, sation Mechanical Engineering, sation Mechanical Engineering, tion Mechanical Engineering, tion Mechanical Engineering, tion Mechanical Engineering, computer Science: Compuls ion Bioprocess Engineering: Cor ion Naval Architecture: Compulso	mpulsory ory rry pulsory mpulsory igineering: Compulsor ulsory cus Mechatronics: Con cus Biomechanics: Con cus Biomechanics: Con cus Aircraft Systems Er g, Focus Materials in h, Focus Theoretical M Focus Product Devel cus Energy Systems: C	npulsory mpulsory ngineering: Compuls Engineering Scient Mechanical Engineer opment and Product



General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
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
Technomathematics: Specialisation II. Informatics: Elective Compulsory

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

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

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



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

4. Combinational Logic Design (Principles)

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

5. Combinational Logic Design (Practices)

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

6. Sequential Logic Design (Principles)

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

7. Sequential Logic Design (Practices)

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

8. Memory, PLDs, CPLDs und FPGAs

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

9. Microprocessor Technology (Principles)

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



Module M0853: Mathematic	cs III			
Courses				
Title		Тур	Hrs/wk	CP
Analysis III (L1028)		Lecture	2	2
Analysis III (L1029)		Recitation Section (small)	1	1
Analysis III (L1030)		Recitation Section (large)	1	1
Differential Equations 1 (Ordinary Differen	tial Equations) (L1031)	Lecture	2	2
Differential Equations 1 (Ordinary Differen	itial Equations) (L1032)	Recitation Section (small)	1	1
Differential Equations 1 (Ordinary Differen	itial Equations) (L1033)	Recitation Section (large)	1	1
Module Responsible	Prof. Anusch Taraz			
Admission Requirements	none			
Recommended Previous	Mathematics I + II			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	following learning results		
· · · ·	Aller laking part successiony, successiony	lonowing learning results		
Professional Competence				
Knowledge	• Students can name the basic concepts in the a	rea of analysis and differential equations. The	v are able to explai	n them using appropria
	examples.		, ,	0 11 1
	Students can discuss logical connections between	n these concepts. They are capable of illustrating	a these connections w	ith the help of examples
	They know proof strategies and can reproduce the		,	
	····) ····· p···· and g··· and an op·····			
01.71				
Skills	• Students can model problems in the area of ana	lysis and differential equations with the help of	the concepts studied	in this course. Moreove
	they are capable of solving them by applying estal	blished methods.		
	Students are able to discover and verify further log		n the course.	
	 For a given problem, the students can develop and 			eulte
			initially evaluate the h	Sound.
Personal Competence				
Social Competence	• Students are able to work together in teams. They	are canable to use mathematics as a common la	nanade	
	 In doing so, they can communicate new concepts 			can design examples
	check and deepen the understanding of their peer			our design examples
	check and deepen the understanding of their peer	-o.		
Autonomy	Students are capable of checking their understar	ading of complex concepts on their own. They c	an specify open ques	tions precisely and kno
	where to get help in solving them.	·····g •· ••···p·•·· ••··•p·• •· •·•· •·		
	 Students have developed sufficient persistence to 	be able to work for langer periods in a goal origin	ntod mannor on hard	arablama
	 Students have developed sufficient persistence to 	be able to work for foriger periods in a goar-one	nieu manner on naru	bioblems.
Workload in Hours	Independent Study Time 128, Study Time in Lecture 112			
Credit points				
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 q	ualification: Compulsory		
Curricula	General Engineering Science (German program, 7 seme	ster): Core qualification: Compulsory		
	Civil- and Environmental Engineering: Core qualification:	Compulsory		
	Bioprocess Engineering: Core qualification: Compulsory			
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification	on: Compulsory		
	General Engineering Science (English program): Core qu			
	General Engineering Science (English program, 7 semes			
	Computational Science and Engineering: Core qualificati			
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory Process Engineering: Core qualification: Compulsory			



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

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

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

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



Course L1032: Differential Equations 1 (Ordinary Differential Equations)		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	
Course L1033: Differential Equation	is 1 (Ordinary Differential Equations)	
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1121: Programmi	ng in C			
Courses				
Title		Тур	Hrs/wk	CP
Programming in C (L0083) Programming in C (L1488)		Lecture Laboratory Course	1	1
Module Responsible	Prof. Siegfried Rump	Laboratory Course	I	I
Admission Requirements	None			
Recommended Previous	Elementary PC handling skills			
Knowledge				
°,	Elementary mathematical skills			
Educational Objectives	After taking part successfully, students have reached the followin	g learning results		
Professional Competence				
Knowledge	The students know by heart the basic syntax of C programming a	s well as its meaning, intent and		
	purpose.			
	They know the fundamental components and principles of eleme	ntany procedural programming		
	based on C programming and can explain them:	mary procedural programming		
	bused on o programming and can explain atom.			
	basic data types (integers, floating point numbers, characters)			
	advanced data types (pointers, arrays, strings, composed data to a strings)			
	operators (arithmetical operations, logical operations, bit operations)	tions)		
	 control flow (choice, loops, jumps, conditional compilation) functions and macros 			
	important standard libraries and functions			
	recursion			
	Inked lists			
	The students are prepared for continuing programming lectures l	ike object oriented programming in C		
	The stadents are prepared for continuing programming rectines i	ine object offented programming in 0++.		
Skills	The students know how to use an integrated development enviro			
	so that they can write, store, compile and execute C programs or	it.		
	Using their knowledge they are able to read and understand give	en C Programs.		
	They can solve simple algorithmic problems on their own and ca	n model and program their solutions		
	in C language.			
	The students are able to solve selected exercises from other area	as of their study like mathematics		
	mechanics, electrical engineering or physics with the aid of small			
	······································			
Personal Competence				
Social Competence	The students are able to work in small teams to solve given week	ly tasks, to identify and analyze		
	programming errors and to present their results.			
	They are able to explain simple phenomena to each other direct	y at the PC.		
Autonomy	The students prepare themselves using the given teaching mate	rial and solve the given		
Autonomy	programming exercises on their own.			
	Additionally, they write small C programs to understand and chee	ck addressed issues and also to		
	gain a certain programming experience.			
	For details beyond the scope of the lecture the students inform the	emselves using the stated		
	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 qualifica	tion: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Co			
	General Engineering Science (English program): Core qualificat			
	General Engineering Science (English program, 7 semester): Co			



Course L0083: Programming in C	
Тур	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Siegfried Rump, Weitere Mitarbeiter
Language	DE/EN
Cycle	SoSe
Content	C-Programming:
	1. basic data types (integers, floating point numbers, characters, boolean values)
	2. 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)
	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
Literature	Kernighan, Brian W (Ritchie, Dennis M.;)
	The C programming language
	ISBN: 9780131103702
	Upper Saddle River, NJ [u.a.] : Prentice Hall PTR, 2009
	Sedgewick, Robert
	Algorithms in C
	ISBN: 0201316633
	Reading, Mass. [u.a.] : Addison-Wesley, 2007
	Kaiser, Ulrich (Kecher, Christoph.;)
	C/C++: Von den Grundlagen zur professionellen Programmierung
	ISBN: 9783898428392
	Bonn : Galileo Press, 2010
	Wolf, Jürgen
	C von A bis Z : das umfassende Handbuch
	ISBN: 3836214113
	Bonn : Galileo Press, 2009

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



Nodule M0833: Introductio				
Courses				
ïtle		Тур	Hrs/wk	CP
ntroduction 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 learners	rning results		
Professional Competence				
Knowledge	 Students can represent dynamic system behavior in time and fi 	requerey demain and ean in particul	lor ovaloia aroaartioo	of first and second ar
	systems	requency domain, and can in particul	iai explain properties	or first and second on
	 They can explain the dynamics of simple control loops and inte 	voret dynamic properties in terms of f	requency response a	nd root locus
	 They can explain the dynamics of simple contenteeps and me They can explain the Nyquist stability criterion and the stability 			
	 They can explain the role of the phase margin in analysis and s 			
	 They can explain the way a PID controller affects a control loop 			
	They can explain issues arising when controllers designed in c		nted digitally	
			0 ,	
Skills	 Students can transform models of linear dynamic systems from 	time to frequency domain and vice v	ersa	
	 They can simulate and assess the behavior of systems and cor 			
	They can design PID controllers with the help of heuristic (Zieg			
	 They can analyze and synthesize simple control loops with the 		ponse techniques	
	They can calculate discrete-time approximations of controllers			ntation
	 They can use standard software tools (Matlab Control Toolbox, 			
		, , ,		
Personal Competence				
Social Competence	Students can work in small groups to jointly solve technical problems,	and experimentally validate their con	troller designs	
Autonomy	Students can obtain information from provided sources (lecture not	es, software documentation, experin	ment guides) and us	e it when solving giv
	problems.			
	They can assess their knowledge in weekly on-line tests and thereby o	control their learning progress		
	They can assess their knowledge in weekly on the tests and thereby c	onaor alon loanning progress.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Workload in Hours Credit points	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6 Written exam			
Credit points Examination	6 Written exam	Compulsory		
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: C	isation Computer Science: Compulso		
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 120 min General Engineering Science (German program): Core qualification: C General Engineering Science (German program, 7 semester): Special	isation Computer Science: Compulso isation Bioprocess Engineering: Com	npulsory	
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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
Process Engineering: Core qualification: Compulsory

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Content Signals and systems Linear systems, differential equations and transfer functions First and second order systems, poles and zeros, impulse and step response Stability Feedback systems Principle of feedback, open-loop versus closed-loop control Reference tracking and disturbance rejection Types of feedback, PID control Reference tracking and disturbance rejection Types of teedback, PID control System type and steady-state error; error constants Internal model principle Root locus techniques Root locus blots Root locus blots Root locus blots Root locus blots Nyuiust plot, Nyuiust stability criterion, phase and gain margin Loop staping, lead at go componation Frequency response interpretation of PID control Time delay systems Root locus and requency response of time delay systems Smith predictor Digital control Sampled-data systems, difference equations Trustin approximation, digital implementation of PID controllers Software tools Introduction to Matlab, Simulink, Control toolbox Computer-based exercices throughout the course 	Language	DE
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 First and second order systems, poles and zeros, impulse and step response Stability Feedback systems Principle of feedback, open-loop versus closed-loop control Referement tracking and disturbance rejection Types of feedback, pith control System type and steady-state error, error constants Internal model principle Root locus techniques Root locus design of PID controllers Frequency response techniques Bode diagram Minimum and non-minimum phase systems Nequiti tot, Nyquist stability criterion, phase and gain margin Loop shaping, lead lag compensation Frequency response Interpretation of PID control Time delay systems Root locus and frequency response of time delay systems Smith predictor Digital control Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers Software tools Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course 	Content	Signals and systems
 Types of feedback, PID control System type and steady-state error, error constants Internal model principle Root locus techniques Root locus design of PID controllers Frequency response techniques Bode diagram Minimum and non-minimum phase systems Nyquist plot, Nyquist stability criterion, phase and gain margin Loop shaping, lead lag compensation Frequency response interpretation of PID control Time delay systems Software tools Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers Software tools Introduction to Mattab, Simulink, Control toolbox Computer-based exercises throughout the course 		 First and second order systems, poles and zeros, impulse and step response Stability Feedback systems Principle of feedback, open-loop versus closed-loop control
Root locus plots Root locus design of PID controllers Frequency response techniques Bode diagram Minimum and non-minimum phase systems Nyquist plot, Nyquist stability criterion, phase and gain margin Loop shaping, lead lag compensation Frequency response interpretation of PID control Time delay systems Root locus and frequency response of time delay systems Smith predictor Digital control Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers Software tools Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course		 Types of feedback, PID control System type and steady-state error, error constants
 Root locus design of PID controllers Frequency response techniques Bode diagram Minimum and non-minimum phase systems Nyquist plot, Nyquist stability criterion, phase and gain margin Loop shaping, lead lag compensation Frequency response interpretation of PID control Time delay systems Root locus and frequency response of time delay systems Smith predictor Digital control Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers Software tools Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course 		Root locus techniques
 Bode diagram Minimum and non-minimum phase systems Nyquist plot, Nyquist stability criterion, phase and gain margin Loop shaping, lead lag compensation Frequency response interpretation of PID control Time delay systems Root locus and frequency response of time delay systems Smith predictor Digital control Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers Software tools Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course 		
 Minimum and non-minimum phase systems Nyquist plot, Nyquist stability criterion, phase and gain margin Loop shaping, lead lag compensation Frequency response interpretation of PID control Time delay systems Root locus and frequency response of time delay systems Smith predictor Digital control Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers Software tools Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course 		Frequency response techniques
 Root locus and frequency response of time delay systems Smith predictor Digital control Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers Software tools Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course 		 Minimum and non-minimum phase systems Nyquist plot, Nyquist stability criterion, phase and gain margin Loop shaping, lead lag compensation
Digital control Sampled-data systems, difference equations Tustin approximation, digital implementation of PID controllers Software tools Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course		Root locus and frequency response of time delay systems
Tustin approximation, digital implementation of PID controllers Software tools Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course		
 Introduction to Matlab, Simulink, Control toolbox Computer-based exercises throughout the course 		
Computer-based exercises throughout the course		Software tools
 Werner, H., Lecture Notes "Introduction to Control Systems" G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009 K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010 R.C. Dorf and R.H. Bishop, "Modern Control Systems", Addison Wesley, Reading, MA 2010 	Literature	 G.F. Franklin, J.D. Powell and A. Emami-Naeini "Feedback Control of Dynamic Systems", Addison Wesley, Reading, MA, 2009 K. Ogata "Modern Control Engineering", Fourth Edition, Prentice Hall, Upper Saddle River, NJ, 2010



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



Specialization Civil- and Enviromental Engeneering

Module M0740: Structural	Analysis I			
Courses				
Title		Тур	Hrs/wk	CP
Structural Analysis I (L0666)		Lecture	2	3
Structural Analysis I (L0667)		Recitation Section (large)	2	3
Module Responsible	Prof. Uwe Starossek	Hookalon Coolon (ki go)	-	5
	FIDE DWE Statussen			
Admission Requirements				
	none			
Recommended Previous	Mechanics I, Mathematics I			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning	roculto		
Professional Competence	Aller taking part successionly, students have reached the following rearning	results		
•				
Knowledge	After successfully completing this module, students can express the basic a	ispects of linear frame analysis of stat	ically determinates	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 o	determinate plane and spatial frame a	and truss structures	
Personal Competence				
Social Competence				
ecolar competence				
Autonomy	The students are able work in-term homework assignments. Due to the in-	term feedback, they are enabled to s	elf-assess their lea	rning progress during
	the lecture period, already.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
	6			
Credit points				
Examination	Written exam			
Examination duration and scale	90 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisation Civil- and		sory	
Curricula	General Engineering Science (German program, 7 semester): Specialisatio	on Civil Engineering: Compulsory		
	Civil- and Environmental Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Civil- and		ory	
	General Engineering Science (English program, 7 semester): Specialisatio			
	Technomathematics: Specialisation III. Engineering Science: Elective Comp	pulsory		

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



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



Module M0613: Reinforced	Concrete I			
Courses				
Title		Тур	Hrs/wk	CP
Project Seminar Concrete I (L0896)		Seminar	1	2
Reinforced Concrete Design I (L0303)		Lecture	2	2
Reinforced Concrete Design I (L0305)		Recitation Section (large)	2	2
Module Responsible	Prof. Günter Rombach			
Admission Requirements	none			
Recommended Previous	Basic knowledge in structural analysis and building materia	ls.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fol	lowing learning results		
Professional Competence				
Knowledge	The students can outline the history of concrete constructi	on and explain the basics of structural engine	ering, including usua	I load combinations an
	safety concepts. They are able to draft and dimension si	mple structures, as well as to evaluate and o	discuss the behaviou	r of the materials and o
	structural members.			
Skilla	The students are able to apply basic procedures of the c	apportion and dimonsioning to practical app	as. They are capable	to draft simple concret
Skills				
	structures and to design them for bending and bending with	n axial lorce, and to plan their detailing and ex	Recution. Moreover, th	ey can make design an
	construction sketches and draw up technical descriptions.			
Personal Competence				
Social Competence				
Autonomy	The students are able to carry out simple tasks in the conce	ption and dimensioning of structures and to crit	tically reflect the result	S.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following	General Engineering Science (German program): Specialis	ation Civil- and Enviromental Engeneering: Co	ompulsory	
Curricula	General Engineering Science (German program, 7 semeste	r): Specialisation Civil Engineering: Compulso	iry	
	Civil- and Environmental Engineering: Core qualification: C	ompulsory		
	General Engineering Science (English program): Specialis	ation Civil- and Enviromental Engeneering: Co	mpulsory	
	General Engineering Science (English program, 7 semeste			
		· · · · · · · · · · · · · · · · · · ·	-	

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



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



Module M0706: Geotechnic	es l			
Courses				
Title		Тур	Hrs/wk	CP
Soil Mechanics (L0550)		Lecture	2	2
Soil Mechanics (L0551)		Recitation Section (large)	2	2
Soil Mechanics (L1493)		Recitation Section (small)	2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	none			
Recommended Previous	Modules :			
Knowledge				
	Mechanics I-II			
Educational Objectives	After taking part successfully, students have reached the follo	owing learning results		
Professional Competence				
Knowledge	The students know the basics of soil mechanics as the s	tructure and characteristics of soil, stress dis	stribution due to we	eight, water or structures,
	consolidation and settlement calculations, as well as failure	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 pro	perties and to evalu	ate them with the help of
	geotechnical standard tests. They can calculate stresses and	d deformation in the soils due to weight or influ	ence of structures. T	hey are are able to prove
	the usability (settlements) for shallow foundations.			
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Civil- and Enviromental Engeneering: Cor	npulsory	
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: Con	npulsory	
	General Engineering Science (English program, 7 semester	: Specialisation Civil Engineering: Compulsory	/	

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



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

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



Courses	
litle	Typ Hrs/wk CP
Signals and Systems (L0432)	Lecture 3 4
Signals and Systems (L0433)	Recitation Section (large) 1 2
Module Responsible	Prof. Gerhard Bauch
Admission Requirements	None
Recommended Previous	Mathematics 1-3
Knowledge	The modul is an introduction to the theory of signals and systems. Good knowledge in maths as covered by the moduls Mathematik 1-3 is 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	
	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse deterministic sig and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image domain which
	caused by the transition of a continuous-time signal to a discrete-time signal.
Skills	The students are able to describe and analyse deterministic signals and linear time-invariant systems using methods of signal and system theory.
on the	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
	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: Comput
	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 Mechationics. Computery General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer
	Compulsory
	Computer Science: Core qualification: Compulsory
	Electrical Engineering: Core qualification: Compulsory
	General Engineering Science (English program): Specialisation Civil- and Enviromental Engeneering: Compulsory
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Computer Science: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compute
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
	Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer
	Compulsory
	Computational Science and Engineering: Core qualification: Compulsory
	Mechatronics: Core qualification: Compulsory



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Onumer 10/00: Cinnels and Custome		
Course L0432: Signals and Systems		
Typ Hrs/wk	2 S	
CP	4	
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42	
Lecturer	Prof. Gerhard Bauch	
Language	DE/EN	
Cycle	SoSe	
Content	Basic classification and description of continuous-time and discrete-time signals and systems	
	Concvolution	
	Power and energy of signals	
	Correlation functions of deterministic signals	
	Linear time-invariant (LTI) systems	
	Signal transformations:	
	Fourier-Series	
	Fourier Transform	
	Laplace Transform	
	Discrete-time Fourier Transform	
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)	
	• Z-Transform	
	Analysis and design of LTI systems in time and frequency domain	
	Basic filter types	
	Sampling, sampling theorem	
	Fundamentals of recursive and non-recursive discrete-time filters	
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004	
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.	
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997	
	J.R. Ohm, H.D. Lüke , Signalübertragung, Springer-Verlag 8. Auflage, 2002	
	S. Haykin, B. van Veen: Signals and systems. Wiley.	
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.	
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.	

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



	nalysis II			
20117000				
Courses				
Γitle		Тур	Hrs/wk	CP
Structural Analysis II (L0673) Structural Analysis II (L0674)		Lecture Recitation Section (large)	2	3 3
		Recitation Section (large)	2	3
	Prof. Uwe Starossek			
	None			
Recommended Previous	Mechanics I/II			
Knowledge	Mathematics I/II			
	Differential Equations I			
	Structural Analysis I			
Educational Objectives	After taking part successfully, students have reached the f	ollowing learning results		
Professional Competence				
	After successful completion of this module, students can e	express the basic aspects of linear frame analy	sis of statically indetermi	nate systems
Mometage			sis of stationly indetermin	nate systems.
Skills	After successful completion of this module, the students a	re able to analyze state variables and to const	ruct influence lines of sta	tically inderminate pla
	and spatial frame and truss structures.			
Personal Competence				
Social Competence				
	The students are able to work in-term homework assign	nments. Due to the in-term feedback, they are	e enabled to self-asses	s their learning progre
	during the lecture period, already.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 Minuten			
Assignment for the Following	General Engineering Science (German program): Special	lisation Civil- and Enviromental Engeneering:	Compulsory	
Curricula	General Engineering Science (German program, 7 semes	ster): Specialisation Civil Engineering: Compul	sory	
	Civil- and Environmental Engineering: Core qualification:	Compulsory		
	General Engineering Science (English program): Special	isation Civil- and Enviromental Engeneering: (Compulsory	
	General Engineering Science (English program, 7 semes	ter): Specialisation Civil Engineering: Compute	sory	

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



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



Courses				
itle		Тур	Hrs/wk	CP
ntroduction to Management (L0880) roject Entrepreneurship (L0882)		Lecture Problem-based Learning	3 2	3 3
Module Responsible	Prof. Christoph Ihl	robien based Learning	L	5
Admission Requirements	,			
Recommended Previous				
Knowledge	-			
Educational Objectives		earning results		
Professional Competence		3		
Knowledge			nagement, from Planr	ing and Organisation
Skills	 explain the differences between Economics and Management field of Management explain the most important aspects of and goals in Managere describe and explain basic business functions as producti ressource management, information management, innovati explain the relevance of planning and decision making in some basic methods from mathematical Finance state basics from accounting and costing and selected contri Students are able to analyse business units with respect to Entrepreneurship project in a team. In particular, they are able to analyse Management goals and structure them appropriate 	ment and name the most important aspe on, procurement and sourcing, supply on management and marketing Business, esp. in situations under mu olling methods. different criteria (organization, object	ects of entreprneurial p chain management, o Iltiple objectives and	projects organization and hum uncertainty, and expl
	 analyse organisational and staff structures of companies apply methods for decision making under multiple objective analyse production and procurement systems and Business analyse and apply basic methods of marketing select and apply basic methods from mathematical finance t apply basic methods from accounting, costing and controlling 	information systems		
Personal Competence Social Competence		ship project and write a coherent report	t on the project	
Autonomy				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points				
Examination				
Examination duration and scale				
Assignment for the Following		ectrical Engineering: Compulsory		
Curricula				
	General Engineering Science (German program): Specialisation Pr	ocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Bi	oprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Er	nergy and Enviromental Engineering: Co	ompulsory	
	General Engineering Science (German program): Specialisation Ci		mpulsory	
	General Engineering Science (German program): Specialisation M			
	General Engineering Science (German program): Specialisation Bi			
	General Engineering Science (German program): Specialisation Na		uleon	
	General Engineering Science (German program 7 semester): Spec		Juisory	
	General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec		ulsorv	
	General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Compu		
	General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Compu- cialisation Biomedical Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Compu- cialisation Biomedical Engineering: Con cialisation Naval Architecture: Compulso	npulsory ory	
	General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Compu- cialisation Biomedical Engineering: Con- cialisation Naval Architecture: Compulso cialisation Computer Science: Compulso	npulsory ory ory	
	General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Compu- cialisation Biomedical Engineering: Con cialisation Naval Architecture: Compulso cialisation Computer Science: Compulso cialisation Bioprocess Engineering: Con	npulsory ory ory npulsory	
	General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Compu- cialisation Biomedical Engineering: Com- cialisation Naval Architecture: Compulso cialisation Computer Science: Compulso cialisation Bioprocess Engineering: Com cialisation Civil Engineering: Compulsor cialisation Energy and Enviromental Eng	npulsory ory npulsory ry gineering: Compulsor	
	General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Compu- cialisation Biomedical Engineering: Com- cialisation Naval Architecture: Compulse cialisation Computer Science: Compulse cialisation Bioprocess Engineering: Com cialisation Civil Engineering: Compulsor cialisation Energy and Enviromental Engi cialisation Mechanical Engineering, Foc	npulsory ory mpulsory ry gineering: Compulsor us Mechatronics: Con	npulsory
	General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Compu- cialisation Biomedical Engineering: Compu- cialisation Naval Architecture: Compulse cialisation Computer Science: Compulse cialisation Bioprocess Engineering: Com cialisation Civil Engineering: Compulsor cialisation Energy and Enviromental Eng- cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc	npulsory ory mpulsory ry gineering: Compulsor cus Mechatronics: Con cus Biomechanics: Co cus Aircraft Systems En	npulsory npulsory ngineering: Compulso
	General Engineering Science (German program, 7 semester): Spec General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Compu- cialisation Biomedical Engineering: Com- cialisation Naval Architecture: Compulso cialisation Computer Science: Compulso cialisation Bioprocess Engineering: Com- cialisation Civil Engineering: Compulso cialisation Energy and Enviromental Eng- cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc cialisation Mechanical Engineering, Foc	npulsory ory npulsory ry gineering: Compulsor cus Mechatronics: Con cus Biomechanics: Co cus Aircraft Systems Ei g, Focus Materials in	npulsory mpulsory ngineering: Compuls Engineering Sciend



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



Course L0880: Introduction to Management		
Тур	Lecture	
Hrs/wk	3	
CP	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. 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 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 	
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 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.		



Module M0580: Principles of	of Building Materials and Building Physics			
A				
Courses		-		
Title		Тур	Hrs/wk	CP
Building Physics (L0217)		Lecture	2	2
Building Physics (L0219)		Recitation Section (large)	1	1
Building Physics (L0247) Principles of Building Materials (L0215)		Recitation Section (small) Lecture	2	2
Module Responsible	Prof. Frank Schmidt-Döhl	2000.0	-	i de la constante de la consta
Admission Requirements	None			
Recommended Previous	Knowledge of physics, chemistry and mathematics from sch	nool		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fol	llowing learning results		
Professional Competence				
Knowledge	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.			
Skills	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.			
Personal Competence				
Social Competence	The students are able to support each other to learn the ver	ry extensive specialist knowledge.		
Autonomy	The students are able to make the timing and the operation	steps to learn the specialist knowledge of a ver	y extensive field.	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	2 stündige Klausur			
Assignment for the Following	General Engineering Science (German program): Specialis	sation Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semeste	er): Specialisation Civil Engineering: Compulsor	ŷ	
	Civil- and Environmental Engineering: Core qualification: C	Compulsory		
	General Engineering Science (English program): Specialis	ation Civil- and Enviromental Engeneering: Con	npulsory	
	General Engineering Science (English program, 7 semeste	r): Specialisation Civil Engineering: Compulson	у	
	Technomathematics: Specialisation III. Engineering Scienc	e: 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
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



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

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



Module M0611: Steel Struct	ures I			
Courses				
Title		Тур	Hrs/wk	CP
Steel Structures I (L0299)		Lecture	2	3
Steel Structures I (L0300)		Recitation Section (large)	2	3
Module Responsible	Dr. Jürgen Priebe			
Admission Requirements	none			
Recommended Previous				
Knowledge	Structural analysis I, Structural analysis II			
	Mechanics I, Mechanics II			
	Building Materials and Building Chemistry			
	Principles of Building Materials and Building	Physics		
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	After passing this module students are able to			
	 give a summary of the security concept 			
	 explain the priciples of the design process 			
	describe and illustrate the bhaviour of memer	rs in tension, compression and bending		
Skills	Students can rate and apply the material steel appro	piately with respect to its properties and usage.		
	They can use the security concept with respect to loa	ds, forces and resistances.		
	They can check the ultimate limit state and the service	eability of simple members in tension, compression ar	nd bending.	
Personal Competence				
Social Competence	After participation of an optional course (building of	a simple truss) they are able to organize themselves	s 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): Sp	ecialisation Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 s	emester): Specialisation Civil Engineering: Compulso	у	
	Civil- and Environmental Engineering: Core qualifica	tion: Compulsory		
	General Engineering Science (English program): Sp	ecialisation Civil- and Enviromental Engeneering: Cor	npulsory	
	General Engineering Science (English program, 7 se	emester): Specialisation Civil Engineering: Compulsor	v	

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



Iodule M0631: Concrete S	Structures II			
Courses				
ītle		Тур	Hrs/wk	CP
Project Concrete Structures II (L0894)		Project Seminar	1	1
Concrete Structures II (L0348)		Lecture	3	4
Concrete Structures II (L0349)	1	Recitation Section (large)	1	1
Module Responsible	Prof. Günter Rombach			
Admission Requirements	none			
Recommended Previous	Knowledge of loads on structures and combination	of actions		
Knowledge	 Basics of safety format are required. 			
	 Knowledge in design of beams and columns for ultil 	mate limit state		
	Lecture 'Concrete Structures I'			
Educational Objectives	After taking part successfully, students have reached the fol	lowing learning results		
Professional Competence				
Knowledge	The students know the basic principles which arev required for design of reinforced concrete structures. They know the various methods to estimate the			
	member forces in simple one and two-way slabs.			
Skills				
	The students can design reinforced concrete structu		rsion) and in the servi	ceability limit state (c
	and deflection control) including detailing (anchorage			
	 The students can estimate the member forces of sim 			
	The students know the content and the layout of a st	ructural analysis		
Personal Competence				
Social Competence	Cooperation in a project work, where they design in a team	a real concrete building and present the result	s at the end.	
Autonomy	. , , , ,,	5 p		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes			
Assignment for the Following	General Engineering Science (German program): Specialis	ation Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semeste			
	Civil- and Environmental Engineering: Core qualification: C		,	
	General Engineering Science (English program): Specialis		mpulsorv	
	General Engineering Science (English program, 7 semeste	• •		

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

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



Module M0728: Hydraulic E	Engineering I			
Courses				
Title		Тур	Hrs/wk	CP
Hydrology (L0909)		Lecture	1	1
Hydrology (L0956)		Problem-based Learning	1	2
Hydromechanics (L0615)		Lecture	2	2
Hydromechanics (L0616)		Recitation Section (large)	1	1
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	none			
Recommended Previous	Mathematics I, II and III			
Knowledge	Mechanik I und II			
	Mechanik rund ir			
Educational Objectives	After taking part successfully, students have reached the follow	ving learning results		
Professional Competence				
Knowledge	The students are able to define the basic terms of hydromecha	nics and hydrology and water management.	They are able to deri	ve the basic formulation
	of i) hydrostatics, ii) kinematics of flows and iii) conservation	aws and to describe and quantify the releva	ant processes of the	hydrological water cycl
	Besides, the students can describe the main aspects of rainfal	-run-off-modelling and of established reserve	oir / storage models a	is well as the concepts
	the determination of a unit-hydrograph.			
Skille	The students are able to apply the fundamental formulations	of hydromochanics to basic practical proble	me Resides this the	ware able to apply bar
Skills	hydrological approaches and methods to simple hydrological			
	models and a unit-hydrograph to given problems.	problems. The stadents have the supusing	to exemplating apply	
	niodolo dila a unit nyalograph to given problemo.			
	In addition, the basic concepts of field - measurements of hyd	rological and hydrodynamic values can be de	escribed and the stud	lents are able to perform
	analyze and assess respective measurements.			
Personal Competence				
Social Competence	The students are able to prepare and present technical preser	tations for given topics in groups.		
Autonomy	Students can provide each other with feedback and sugges	ions on their results. They are capable of r	reflecting their study	techniques and learnir
	strategy on an individual basis.			
Weddeedballe				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70 6			
Credit points Examination	Written exam			
Examination Examination duration and scale	The duration of the examination is 2 hours. The examination	n includes tasks with respect to the const	al understanding of	the leature contents of
Examination duration and scale	calculations tasks.	in includes lasks with respect to the genera	ai understanding of	ine recture contents ar
Assignment for the Following	General Engineering Science (German program): Specialisati	on Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program, 7 semester):			
Surricula	Civil- and Environmental Engineering: Core qualification: Com		y	
	General Engineering Science (English program): Specialisation		nnulson	
	General Engineering Science (English program). Specialisation			
	General Engineering Science (English program, 7 semester):	specialisation Civil Engineering: Compulsory	у	

Course L0909: Hydrology	
Тур	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
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



Module M0755: Geotechnic	es II			
Courses				
Title		Тур	Hrs/wk	CP
Foundation Engineering (L0552)		Lecture	2	2
Foundation Engineering (L0553)		Recitation Section (large)	2	2
Foundation Engineering (L1494)		Recitation Section (small)	2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	none			
Recommended Previous	Modules:			
Knowledge				
	Mechanics I-II			
	Geotechnics I			
Educational Objectives	After taking part successfully, students have reach	ed the following learning results		
Professional Competence				
Knowledge	The students know the basic principles and method	ds which are required to verificate the stability of geotec	hnical structures.	
Skills	After successful completion of the module the stud	lents are able to:		
	 verificate the stability and usability of found 	lationa		
		ement and apply them in their range of application,		
	 design retaining walls. 	ement and apply them in their range of application,		
	• design retaining waits.			
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time in Lecture	9 84		
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 Minuten			
Assignment for the Following	General Engineering Science (German program):	Specialisation Civil- and Enviromental Engeneering: Co	ompulsory	
Curricula	General Engineering Science (German program,	7 semester): Specialisation Civil Engineering: Elective C	ompulsory	
	Civil- and Environmental Engineering: Core qualit	fication: Compulsory		
	General Engineering Science (English program):	Specialisation Civil- and Enviromental Engeneering: Co	mpulsory	
		' semester): Specialisation Civil Engineering: Elective C		

Course L0552: Foundation Engineering		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	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		Tur	Hrs/wk	CP
		Typ Lecture	пгѕ/wк 2	2
Wastewater Disposal (L0276) Wastewater Disposal (L0278)			2	2
Drinking Water Supply (L0306)		Recitation Section (large)	2	1
Drinking Water Supply (L0308)		Lecture Recitation Section (large)	2	2
Module Responsible	Prof. Ralf Otterpohl	recitation Section (large)	I	2
Admission Requirements	none			
Recommended Previous				
	Basic knowledge on Chemistry and Biology			
Knowledge	 Hydraulics of pipe systems and open channels 			
	 Basic knowledge on water management: water q 	antity and water quality		
	Basic knowledge on Environmental Legislation: F			
	· Dasic knowledge on Environmental Legislation.			
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	The students can examplify their expert knowledge on u	ban water infrastructures. They can present the d	erivation and detailed	d explanation of import
	standards for the design of drinking water supply and	wastewater disposal systems in Germany and	hey are capable of	reproducing the relev
	empiricals assumptions and scientific simplifications. The			
	used for drinking and wastewater treatment. They can a		• • • •	
	• • •			
	saftey aspects. Furthermore, they know how to draft th		lologies of the luture	e such as nigh- and i
	pressure membrane filtration systems and techniques for	the removal of trace pollutants.		
Skills	The students are able to apply the relevant standards a	nd guidelines for the design and operation of ur	oan water infrastructu	ures independently. Th
en me	expertise comprises expert skills to design drinking wate	• • •		
	acquirement of technical skills the students are able to a		•	
	The students are also able to develop ideas of their own	to improve the existing water related infrastructure	s, systems and conc	epts.
Personal Competence				
Social Competence	Students are able to form concepts on their own to opti	mize urban water infrastructure processes. There	foro thoy can acquir	a appropriato knowlog
Social Competence				
	when being given some clues or information with regard	to the approach to problems (preparation and toll	ow-up of the exercise	is).
Autonomy				
Workload in Hours	 Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specia	lisation Civil- and Enviromental Engeneering: Co	mpulsory	
Curricula	General Engineering Science (German program). Special			
Curricula		, , , , , , , , , , , , , , , , , , , ,	mpulsory	
	Civil- and Environmental Engineering: Core qualification			
	General Engineering Science (English program): Specia			
	General Engineering Science (English program, 7 seme	stor): Specialization Civil Engineering: Elective Co	mpulooru	



se L0276: Wastewater Disposa	
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: Oldenbor 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. Au Renningen: expert-Verl. Water and wastewater technology Hammer, M. J. 1., & . (2012). (7. ed., internat. ed.). Boston [u.a.]: Pearson Education International. Water and wastewater engineering : design principles and practice: Davis, M. L. 1. (2011) New York, NY: McGraw-Hill. Biological wastewater treatment: (2011). C. P. Leslie Grady, Jr. (3. ed.). London, Boca Raton, Fla. [u.a.]: IWA Publ.

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



Course L0306: Drinking Water Supp	ly
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 I	Engineering II			
Courses				
Title		Тур	Hrs/wk	CP
Hydraulics (L0957)		Lecture	1	1
Hydraulics (L0958)		Recitation Section (large)	1	1
Hydraulic Engineering (L0959)		Lecture	2	2
Hydraulic Engineering (L0960)		Recitation Section (large)	1	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	none			
Recommended Previous	Hydraulik Engineering I			
Knowledge				
Educational Objectives	After taking part successfully, students have rea	ached the following learning results		
Professional Competence				
Knowledge	Students are able to define the basic terms of	f hydraulic engineering and hydraulics. They are able to	explain the applicatio	n of basic hydrodyna
0		hydraulic engineering problems. Besides this, the stude		
		ngineering, flood protection, hydraulic power engineering a		
				-
Skills	The students are able to apply hydraulic engine	eering methods and approaches to basic practical probler	ns and design respect	ive hydraulic enginee
	systems. Besides this, they are able to use and	apply established approaches of hydraulics and determin	e water surfaces of ch	annel flows, influence
	constructions (weirs, etc.) on channel flows as w	well as flow conditions of pipe system.		
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 110, Study Time in Le	cture 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 gene	eral understanding of	the lecture contents
	calculations tasks.			
Assignment for the Following	General Engineering Science (German program	m): Specialisation Civil- and Enviromental Engeneering: C	ompulsory	
Curricula	0 0 1 0	m, 7 semester): Specialisation Civil Engineering: Elective (1	
	Civil- and Environmental Engineering: Core qu			
	General Engineering Science (English program	n): Specialisation Civil- and Enviromental Engeneering: Co	ompulsorv	

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

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



Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	Fundamentals of hydraulic engineering
	Introduction and hydrological cycle
	River engineering
	 Regime theory of natural rivers
	 Sediment transport
	 Regulation of rivers
	 Bank protection / protection of river bed
	Tidal rivers
	Flood protection
	• 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
	r au, n. u Gonsowski, r. wasserodu, opringer 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 Energy and Enviromental Engineering

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

Module M0598: Mechanical	Engineering: Design			
Courses				
Title		Тур	Hrs/wk	CP
Embodiment Design and 3D-CAD (L0268)		Lecture	2	1
Mechanical Design Project I (L0695)		Practical Course	3	2
Mechanical Design Project II (L0592)		Practical Course	3	2
Feam Project Design Methodology (L0267)	Problem-based Learning	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous				
Knowledge	 Fundamentals of Mechanical Engineering Design 			
	Mechanics			
	 Fundamentals of Materials Science 			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the follo	owing learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	explain design guidelines for machinery parts e.g. co	insidering load situation, materials and manu	acturing requirements	,
	describe basics of 3D CAD,			
	 explain basics methods of engineering designing. 			
Skills	After passing the module, students are able to:			
	 independently create sketches, technical drawings a 	nd documentations e.g. using 3D CAD		
	 design components based on design guidelines auto 			
	 dissign components based on design guidelines add dimension (calculate) used components, 	Shomously,		
	 use methods to design and solve engineering design 	tacks systematically and solution oriented		
		riasks systamically and solution-onemed,		
	 apply creativity techniques in teams. 			
Personal Competence				
Social Competence	After passing the module, students are able to:			
	 develop and evaluate solutions in groups including r 	naking and documenting decisions,		
	moderate the use of scientific methods,			
	 present and discuss solutions and technical drawing 			
	 reflect the own results in the work groups of the cours 	Se.		
Autonomy	Students are able			
	 to estimate their level of knowledge using activating 	methods within the lectures (e.g. with clickers	5),	
	To solve engineering design tasks systematically.			
Workload in Hours	Independent Study Time 40, Study Time in Lecture 140			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180			
Assignment for the Following	General Engineering Science (German program): Specialisa	ation Energy and Enviromental Engineering: (Compulsory	
Curricula	General Engineering Science (German program): Specialisa	ation Mechanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program, 7 semester	r): Specialisation Mechanical Engineering: Co	mpulsory	
	General Engineering Science (German program, 7 semester			
	General Engineering Science (German program, 7 semester			Ŷ
	Energy and Environmental Engineering: Core qualification:			-
	General Engineering Science (English program): Specialisa		ompulsorv	
	General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa			
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program, 7 semester	0 0 1 ,	mpulsory	
	General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 semester			
	General Engineering Science (English program, 7 semester	j. Specialisation Energy and Enviromental En	gineening: Compuisor	у
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			



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

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



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

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



Courses					
Title		Тур	Hrs/wk	CP	
Introduction to Energy and Environmenta	Engineering (L0212)	Problem-based Learning	4	3	
Physics-Lab for VT/ BVT/ EUT (L0947)		Laboratory Course	2	3	
Module Responsible	Prof. Alfons Kather				
Admission Requirements	None				
Recommended Previous	None				
Knowledge					
Educational Objectives	After taking part successfully, students have reached the foll	owing learning results			
Professional Competence					
Knowledge	The students can sketch the different options for electricity a	and heat generation and gain insight into env	ironmental engineerir	ig technology. On a ba	
	level they are able to present and discuss the technical	and environmental engineering advantage	s and disadvantages	(balancing act betwe	
	affordable energy usage and minimization of environme	ntal impact) of the different alternatives. T	hey are aware the o	dimension of their fut	
	responsibility and know about the necessity to find comprom	ises between energy usage and environmen	protection.		
	Through a practical course in physics the students learn to c	eliver an overview of specialist aspects of phy	vsics		
	······································				
Skills	The students master the fundamentals of technical communication. They are able to explain specialized topics orally. By comparing analysis of literatu				
	sources, students are able to work scientifically to critically d	iscuss them on a basic level.			
	The students are able to communicate their deepened physics knowledge in ways of written technical communication.				
	The students are able to communicate their deepened phys	is knowledge in ways of written technical cor	intumcation.		
Personal Competence					
Social Competence	The social skills of the students within the group but also wit	h the visited Company are strengthened. For	the preparation of the	Seminar presentation	
	students learn communication.				
	The exection environment in Displace is also conviced out in success		to The shudests show	a the set of south set the side set	
	The practical course in Physics is also carried out in group		is. The students stren	igthen lurther their so	
skills, can achieve in group common results and report them in joint protocols.					
Autonomy	In the seminar the students learn individually to formulate co	and unions realistically representing the arrest	The students are -	alo to work independent	
Autonomy	on specific technical subjects and to present these to the gro		s. The sludents are at	ble to work independe	
	on specific technical subjects and to present these to the gro	Jup.			
	The students are able to familiarize themselves with experin	nental demonstrations and individually prepar	e and present a short	experimental report.	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84				
Credit points	6				
Examination	Presentation				
Examination duration and scale	EEUT: Compulsory attendance and seminar incl. discussion	on: Physics ab: error calculation seminar: 6	Experimente with in	trod seminar (20 min	
Examination our ation and SCale	handwritten pages preparatory script, transcript on their owr			100. Jonnai (20 11111	
Assignment for the Following					
Assignment for the Following General Engineering Science (German program): Specialisation Energy and Enviromental Engineering: Compulsory Curricula Energy and Environmental Engineering: Core qualification: Compulsory					
Guificula	General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory				

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



Osena 10047 Physics Leb (se M7/	
Course L0947: Physics-Lab for VT/	BVI/EUI
Тур	Laboratory Course
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Wolfgang Hansen
Language	DE/EN
Cycle	WiSe
	In the physics lab a number of key experiments on physical phenomena in mechanics, oscillatory and wave motion, thermodynamics, electricity, and optics will be conducted by the students under assistance of a lecturing tutor. The experiments are part of the physics education program presented in the course "Physics for TUHH-VT Engineers". Beyond teaching of fundamental physical background the objectives are basic skills in preparation and performing physical measurements, usage of physical equipment, analysis of the results and preparation of a report on the experimental data. The students receive instructions in terms of scientific writing as well as feedback on their own reports and level of scientific writing. Before every experiment an colloquium takes place in which the students explain and discuss the theoretical background and its translation into practice with the corresponding experiment.
Literature	Zu den Versuchen gibt es individuelle Versuchsanleitungen, die vor der Versuchsdurchführung ausgegeben werden. Zum Teil müssen die zur Versuchsdurchführung notwendigen physikalischen Hintergründe selbstständig erarbeitet werden, wozu die zur Vorlesung "Physik für TUHH-VT Ingenieure" angegebene Literatur gut geeignet ist.



Madula NOFOC: Fundament				
Module M0536: Fundament	als of Fiuld Mechanics			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Fluid Mechanics (L0091)	(1,000)	Lecture	2	4
Fluid Mechanics for Process Engineering		Recitation Section (large)	2	2
	Prof. Michael Schlüter			
Admission Requirements	None			
Recommended Previous	Mathematics I+II+III			
Knowledge	Technical Mechanics I+II			
	Technical Thermodynamics I+II			
	Working with force balances			
	Simplification and solving of partial differential equations			
	Integration			
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	Students are able to:			
	explain the difference between different types of flow			
	 give an overview for different applications of the Reynolds 	Transport-Theorem in process engineer	ring	
	• explain simplifications of the Continuity- and Navier-Stoke	s-Equation by using physical boundary of	conditions	
Skills	The students are able to			
	describe and model incompressible flows mathematically			
	 reduce the governing equations of fluid mechanics by simplifications to archive quantitative solutions e.g. by integration 			
	notice the dependency between theory and technical app	lications		
	 use the learned basics for fluid dynamical applications in 	fields of process engineering		
Personal Competence				
Personal Competence	The students			
Social Competence	The students			
	 are capable to gather information from subject related, pro 	fessional publications and relate that inf	ormation to the context	of the lecture and
	 able to work together on subject related tasks in small group 	ups. They are able to present their resul	ts effectively in English	(e.g. during small grou
	exercises)			
	are able to work out solutions for exercises by themselves	, to discuss the solutions orally and to pre-	esent the results.	
Autonomy	The students are able to			
Autonomy				
	 search further literature for each topic and to expand their 	knowledge with this literature,		
	work on their exercises by their own and to evaluate their	actual knowledge with the feedback.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination Examination duration and scale	Written exam 3 hours			
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation			
Gurricula	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation	1 0 0 1 3	Compulsory	
	General Engineering Science (German program, 7 semester): Sp			
	General Engineering Science (German program, 7 semester). Sp General Engineering Science (German program, 7 semester): Sp		-	
	General Engineering Science (German program, 7 semester): Sp General Engineering Science (German program, 7 semester): Sp			v
	Bioprocess Engineering: Core qualification: Compulsory		-aoor.ing. oompulaol	,
	Energy and Environmental Engineering: Core qualification: Com	pulsory		
	General Engineering Science (English program): Specialisation I	•		
	General Engineering Science (English program): Specialisation I		ompulsory	
	General Engineering Science (English program): Specialisation I			
	General Engineering Science (English program, 7 semester): Sp		ulsory	
	General Engineering Science (English program, 7 semester): Sp		-	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Energy and Environmental En	gineering. Compulsory	r
	General Engineering Science (English program, 7 semester): Sp. Technomathematics: Specialisation III. Engineering Science: Ele-		gineering. Compulsory	1



ourse L0091: Fundamentals of Fluid	d Mechanics
Тур	Lecture
Hrs/wk	2
CP 4	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, Berli Heidelberg, New York, 2006 Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage Gmbl Wiesbaden, 2008 Kuhlmann, H.C.: Strömungsmechanik: München, Pearson Studium, 2007 Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GW Fachverlage GmbH, Wiesbaden, 2009 Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007 Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berli Heidelberg, 2008 Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006

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, Mcgraw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011



Module M0610: Electrical M	lachines				
Courses					
Title		Тур	Hrs/wk	CP	
Electrical Machines (L0293)		Lecture	3	4	
Electrical Machines (L0294)		Recitation Section (large)	2	2	
Module Responsible	Prof. Günter Ackermann				
Admission Requirements	none				
Recommended Previous	Basics of mathematics, in particular complexe numbers, integrals, d	ifferentials			
Knowledge	Basics of electrical engineering and mechanical engineering				
	basics of electrical engineering and mechanical engineering				
Educational Objectives	After taking part successfully, students have reached the following I	earning results			
Professional Competence					
Knowledge	Students can to draw and explain the basic principles of electric an	d magnetic fields.			
	They can describe the function of the standard types of electric	machines and present the correspon	ding equations and a	parastaristia survas. Es	
	typically used drives they can explain the major parameters of the e				
	typically used drives they call explain the major parameters of the e	nergy enciency of the whole system in	on the power gild to th	e unven engine.	
Skills	Students arw able to calculate two-dimensional electric and magne	tic fields in particular ferromagnetic ci	rcuits with air gap. For	this they apply the usua	
	methods of the design auf electric machines.				
	They can calulate the operational performance of electric machines from their given characteristic data and selected quantities and characteristic				
	They apply the usual equivalent circuits and graphical methods.				
	· ,				
Personal Competence					
Social Competence	none				
Autonomy					
	performance of electric machines from the charactersitic data and the				
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 Er	ergy and Enviromental Engineering: (Compulsory		
Curricula	General Engineering Science (German program): Specialisation Me				
	General Engineering Science (German program, 7 semester): Spec			/	
	General Engineering Science (German program, 7 semester): Spec	ialisation Mechanical Engineering: El	ective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory				
	Energy and Environmental Engineering: Core qualification: Compu	lsory			
	General Engineering Science (English program): Specialisation En	ergy and Enviromental Engineering: C	Compulsory		
	General Engineering Science (English program): Specialisation Me	chanical Engineering: Elective Compu	ulsory		
	General Engineering Science (English program, 7 semester): Spec	alisation Energy and Enviromental En	gineering: Compulsory		
	General Engineering Science (English program, 7 semester): Spec	alisation Mechanical Engineering: Ele	ective Compulsory		
	Computational Science and Engineering: Specialisation Engineering	ng Sciences: Elective Compulsory			
	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		
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: Renewables	s and Energy Systems			
Courses				
Title		Тур	Hrs/wk	CP
Power Industry (L0316)		Lecture	1	1
Energy Systems and Energy Industry (L03	315)	Lecture	2	2
Renewable Energy (L0313)		Lecture	2	2
Renewable Energy (L1434)		Recitation Section (small)	1	1
Module Responsible	Prof. Martin Kaltschmitt			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the for	llowing learning results		
Professional Competence				
Knowledge	With completion of this module, the students can provide explain the issues occurring in this context. Furthermore, to subject-related contexts. The students can explain thes energy systems and critical discuss them. Furthermore, the	hey can explain details of power generation, pe e aspects, which are applicable to many energ	ower distribution and y systems in general,	power trading wih regard especially for renewable
Skills	Students are able to apply methodologies for detailed of Furthermore, they can evaluate energy systems technic Therefore, they can choose the necessary subject-specific The students are able to explain questions and possible a into the right context.	cally, environmentally and economically and calculation rules, also for not standardized solu	design them under tions of a problem.	certain given conditions.
Personal Competence				
Social Competence	The students are able to analyze suitable technical a	Iternatives and to assess them with technic	al, economical and	ecological criteria under
	sustainability aspects. This allows them to make an effectiv	e contribuition to a more sustainable power sup	oply.	
Autonomy	Students can independently exploit sources , acquire the p	particular knowledge about the subject area and	l 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): Speciali	sation Energy and Enviromental Engineering: C	Compulsory	
Curricula	General Engineering Science (German program, 7 semes	er): Specialisation Energy and Enviromental Er	ngineering: Compulso	ry
	General Engineering Science (German program, 7 semes	er): Specialisation Mechanical Engineering, Fo	cus Energy Systems:	Elective Compulsory
	Energy and Environmental Engineering: Core qualification	: Compulsory		
	General Engineering Science (English program): Specialis		ompulsory	
	General Engineering Science (English program, 7 semest	er): Specialisation Energy and Enviromental En	gineering: Compulsor	У
	General Engineering Science (English program, 7 semest	er): Specialisation Mechanical Engineering, Foo	cus Energy Systems: E	Elective Compulsory
	Consider Engineering Obience (English program, 7 Sellies)		Sao Linergy Systems. E	

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



Course L0315: Energy Systems and	I Energy Industry
Тур	Lecture
Hrs/wk	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		
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				
	and the lecturer.				
	Possible tasks in the field of renewable energies are:				
	Solar thermal heat				
	Concentrating solare power				
	Photovoltaic				
	Windenergie				
	Hydropower				
	Heatpump				
	Deep geothermal energy				
Literature	 Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2006, 4. Auflage Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Renewable Energy - Technology, Economics and Environment; Springer, Berlin, Heidelberg, 2007 				



courses				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880) roject Entrepreneurship (L0882)		Lecture Problem-based Learning	3 2	3 3
Module Responsible	Prof. Christoph Ihl	Frobient blased Estiming	L	5
Admission Requirements	None			
Recommended Previous				
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 ma Marketing and Innovation, and also to Investment and Controlling.		agement, from Planr	ing and Organisatior
	explain the differences between Economics and Managem	ent and the sub-disciplines in Manageme	ent and to name impo	rtant definitions from
	field of Management			
	explain the most important aspects of and goals in Manage			
	 describe and explain basic business functions as product ressource management, information management, innovati 		chain management, c	organization and nur
	 explain the relevance of planning and decision making in 		tiple objectives and	uncertainty and expl
	some basic methods from mathematical Finance			and exp
	 state basics from accounting and costing and selected cont 	rolling methods.		
Skills	Students are able to analyse business units with respect to	different criteria (organization, object	tives, strategies etc.) and to carry out
	Entrepreneurship project in a team. In particular, they are able to			
	analyse Management goals and structure them appropriate	ly		
	analyse organisational and staff structures of companies			
	apply methods for decision making under multiple objective			
	 analyse production and procurement systems and Business 	s information systems		
	analyse and apply basic methods of marketing			
	 select and apply basic methods from mathematical finance apply basic methods from accounting posting and controlling 			
	 apply basic methods from accounting, costing and controlling 	ig to predefined problems		
Personal Competence				
Social Competence	Students are able to			
	 work successfully in a team of students 			
	 to apply their knowledge from the lecture to an entrepreneu 	rship project and write a coherent report	on the project	
	 to communicate appropriately and 			
	• to cooperate respectfully with their fellow students.			
A	Chudente que oble te			
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				
	90 Minuten			
Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation E	lectrical Engineering: Compulsory		
Examination duration and scale	General Engineering Science (German program): Specialisation E			
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation E	omputer Science: Compulsory		
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C	omputer Science: Compulsory rocess Engineering: Compulsory		
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation P	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory	mpulsory	
Examination duration and scale Assignment for the Following	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 General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation E	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory nergy and Enviromental Engineering: Co ivil- and Enviromental Engeneering: Com		
Examination duration and scale Assignment for the Following	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 General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation C	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory nergy and Enviromental Engineering: Co ivil- and Enviromental Engeneering: Com lechanical Engineering: Compulsory		
Examination duration and scale Assignment for the Following	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 General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation M	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory nergy and Enviromental Engineering: Co ivil- and Enviromental Engeneering: Com lechanical Engineering: Compulsory iomedical Engineering: Compulsory		
Examination duration and scale Assignment for the Following	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 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 M General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation B General Engineering Science (German program): Specialisation N	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory nergy and Enviromental Engineering: Co ivil- and Enviromental Engeneering: Com lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory	npulsory	
Examination duration and scale Assignment for the Following	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 General Engineering Science (German program): Specialisation E General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation C General Engineering Science (German program): Specialisation M 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	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory nergy and Enviromental Engineering: Co- ivil- and Enviromental Engeneering: Com- lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compu	ulsory	
Examination duration and scale Assignment for the Following	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 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 M General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory nergy and Enviromental Engineering: Co ivil- and Enviromental Engeneering: Com lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compul cialisation Process Engineering: Compul	ulsory sory	
Examination duration and scale Assignment for the Following	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 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 M General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory nergy and Enviromental Engineering: Co ivil- and Enviromental Engeneering: Com lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compul cialisation Process Engineering: Compul cialisation Biomedical Engineering: Comput	ulsory sory pulsory	
Examination duration and scale Assignment for the Following	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 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 M General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory nergy and Enviromental Engineering: Co ivil- and Enviromental Engeneering: Com lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compu- cialisation Process Engineering: Compu- cialisation Biomedical Engineering: Compu- cialisation Naval Architecture: Compulso	ulsory sory pulsory ry	
Examination duration and scale Assignment for the Following	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 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 M General Engineering Science (German program): Specialisation M General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program): Specialisation N General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe General Engineering Science (German program, 7 semester): Spe	omputer Science: Compulsory rocess Engineering: Compulsory ioprocess Engineering: Compulsory nergy and Enviromental Engineering: Co- ivil- and Enviromental Engeneering: Com- lechanical Engineering: Compulsory iomedical Engineering: Compulsory aval Architecture: Compulsory cialisation Electrical Engineering: Compu- cialisation Process Engineering: Compu- cialisation Biomedical Engineering: Compu- cialisation Naval Architecture: Compulso cialisation Computer Science: Compulso	Ilsory sory pulsory ry ry	
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General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:	
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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	
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General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory	
General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory	
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory	
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory	
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory	
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:	
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General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:	
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General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:	
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General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory	
Computational Science and Engineering: Core qualification: Compulsory	
Logistics and Mobility: Core qualification: Compulsory	
Mechanical Engineering: Core qualification: Compulsory	
Mechatronics: Core qualification: Compulsory	
Naval Architecture: Core qualification: Compulsory	
Technomathematics: Core qualification: Compulsory	
Process Engineering: Core qualification: Compulsory	



Тур	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfg
	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
	 Introduction to business and management, Important definitions from Management,
	 Developing Objectives for Business, and their relation to important Business functions
	 Beveloping Objectives of 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
	 Introduction to business Praining and the steps of a praining process Decision Analysis: Elements of decision problems and methods for solving decision problems
	 Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing
	Relevance of Controlling and selected Controlling methods
	Important aspects of Entrepreneurship projects
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
	Weber, J., Schäffer, U. : Einführung in das Controlling, 12. Auflage, Stuttgart 2008.
	Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Course L0882: Project Entrepreneu	ourse L0882: Project Entrepreneurship		
Тур	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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Recommended Pervise Mater veneroping Technologi	Module Responsible	Prof. Irina Smirnova			
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Prodesided Competence / Notationspin • The students are capable of deripating qualitative and determining quantitative that landsfir in procedural apparatus (e.g., heat exchance derivers) in the students have the ability to explain the physical basis for mass transfer in detail and to detactive metal-intermediation, heat transfer and their metal-intermediation and the students have the ability to explain the physical basis for mass transfer in detail and to detactive and the interface of the students have the ability to explain the physical basis for mass transfer in detail and to detactive and the interface of the students are able to set massonable system boundaries for a given transport problem by using the gamed brookedge and to batance corresponding energy and mess for any energy to the students. • The students are able to set massonable system boundaries for a given transport problem by using the gamed brookedge and to batance corresponding energy and mess for any energy to the students. • The students are able to set massonable system boundaries for a given transport problem by using the gamed brookedge and to batance corresponding heat form. • Using density of a students. • Using density of a students. • The students are able to set massonable system boundaries for a given transport problem by using the gamed brookedge to the doop and adding upper students. • The students are able to set massonable system boundaries for a given transport problem by using the gamed brookedge to the doop and adding upper students. • The students are able to set massonable system boundaries for a given transport problem to the doop to doop and the base adding to the adding to the ad	Knowledge				
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Examination duration and scale 120 minutes; theoretical questions and calculations Assignment for the Following Curricula General Engineering Science (German program): Specialisation Process Engineering: Compulsory General Engineering Science (German program): Specialisation Energy and Environmental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess 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 Bioprocess Engineering: Core qualification: Compulsory Bioprocess 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): 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	· ·				
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General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory Bioprocess Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (English program): Specialisation Process Engineering: Compulsory General Engineering Science (English program): Specialisation Process 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 Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory Technomathematics: Specialisation III. Engineering Science: Elective Compulsory Technomathematics: Core qualification: Elective Compulsory					
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Technomathematics: Specialisation III. Engineering Science: Elective Compulsory Technomathematics: Core qualification: Elective Compulsory		General Engineering Science (English program, 7 semester): Specia	lisation Bioprocess Engineering: Co	mpulsory	
Technomathematics: Core qualification: Elective Compulsory				igineering: Compulsory	/
			Compulsory		
		Technomathematics: Core qualification: Elective Compulsory Process Engineering: Core qualification: Compulsory			



Course L0101: Heat and Mass Trans	sfer
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 Mass transfer one-way diffusion, equimolar countercurrent diffusion boundary layer theory, non-steady mass transfer Heat and mass transfer single particle/ fixed bed Mass transfer and chemical reactions
Literature	 H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer VDI-Wärmeattas

Course L0102: Heat and Mass Trans	sfer		
Тур	vitation Section (small)		
Hrs/wk			
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 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. 		
	1. H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer 2. VDI-Wärmeatlas		



Module M0546: Thermal Se	paration Processes				
Courses					
		T	Hus fords	0.5	
Title		Тур	Hrs/wk	CP	
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 followi	ng learning results			
Professional Competence					
Knowledge					
	 The students can distinguish and describe different type 	s of separation processes such as distillation	n, extraction, and ad	sorption	
	The students develop an understanding for the course	of concentration during a separation proce	ss, the estimation of	the energy demand of	
	process, the possibilities of energy saving, and the selec	tion of separation systems			
	 They have good knowledge of designing methods for se 	paration processes and devices			
Skills					
	 Using the gained knowledge the students can select a result. 	easonable system boundary for a given sep	aration process and	can close the associate	
	energy and material balances				
	 The students can use different graphical methods for the 	designing of a separation process and defi	ne the amount of the	oretical stages required	
	 They can select and design a basic type of thermal set 				
	process	Farance Freeze a 9.100 and 1000 a			
		adad material properties from appropriate s	ouroos (diagrams a	nd tables)	
	The students are capable to obtain independently the new		ources (ulagranis a	iu labies)	
	They can calculate continuous and discontinuous proce				
	 The students are able to prove their theoretical knowledge 				
	The students are able to discuss the theoretical background and the content of the experimental work with the teachers in colloquium.				
	The students are canable of linking their gained knowledge wi	th the content of other lectures and use it to	aether for the soluti	on of technical problems	
	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.				
	one recures such as thermodynamics, into mechanics and or	lennear engineering.			
Personal Competence					
Social Competence	 The students can work technical assignments in small a 	round procent the combined regults in th			
	 The students can work technical assignments in small groups 	oups and present the combined results in tr	ie lutorial		
	The students are able to carry out practical lab work in		sion of labor betwee	en them. They are able t	
	discuss their results and to document them scientifically	in a report.			
A					
Autonomy	 The students are capable to obtain the needed informati 	on from suitable sources by themselves and	l assess their quality		
	 The students can proof the state of their knowledge with 	•			
	The states are provide state of their knowledge with		,		
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	n Process Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisation				
	General Engineering Science (German program): Specialisation Energy and Environmental Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory				
General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory					
	Bioprocess Engineering: Core qualification: Compulsory				
	Energy and Environmental Engineering: Core qualification: Cor	npulsory			
	General Engineering Science (English program): Specialisation				
	General Engineering Science (English program): Specialisation		mpulsory		
	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): S	pecialisation Bioprocess Engineering: Com	pulsorv		
				V	
	General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S			у	



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 devices without discrete stages Designing of separation processes Chromatographic separation processes Membrane separation Energy demand of separation processes
Literature	Advance overview of separation processes Selection of separation processes
	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinko 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 Ullman Enzyklopädie der Technischen Chemie



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 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. Steinkoj Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry's Chemical Engineers' Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann Enzyklopädie der Technischen Chemie



Course L0141: Thermal Separation	
Тур	
Hrs/wk	
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	 Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extraction: separation ternary systems, ternary diagram Multiphase separation including complex mixtures Designing of separation devices without discrete stages Drying Chromatographic separation processes 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. Steinkopf Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verfag, Weinheim, 2006. Perry''s Chemical Engineers'' Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann'' Enzyklopädie der Technischen Chemie



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 t students explain and discuss the theoretical background and its translation into practice with staff and fellow students.
	The students explain and discuss the theoretical background and its inansiation into practice with star and lenow students. The students work small groups with a high degree of division of labor. For every experiment, the students write a report. They receive instructions terms of scientific writing as well as feedback on their own reports and level of scientific writing so they can increase their capabilities in this area. Topics of the practical course:
	 Introduction in the thermal process engineering and to the main features of separation processes Simple equilibrium processes, several steps processes Distillation of binary mixtures, enthalpy-concentration diagrams Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extractive and azeotrope distillation, water vapor distillation Extractive and azeotrope distillation, water vapor distillation, stepwise distillation Extractive and azeotrope distillation, water vapor distillation Extractive and azeotrope distillation represent the distillation Designing of separation devices without discrete stages Drying Chromatographic separation processes Advance overview of separation processes Selection of separation processes Selection of separation processes
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkop Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann Enzyklopädie der Technischen Chemie



Module M0956: Measureme	ent Technology for Mechanical and Proces	ss Engineers			
Courses					
Title		Тур	Hrs/wk	CP	
Practical Course: Measurement and Conti	rol Systems (I 1119)	Laboratory Course	2	2	
Measurement Technology for Mechanical		Lecture	2	3	
Measurement Technology for Mechanical		Recitation Section (large)	1	1	
Module Responsible	Dr. Sven Krause				
Admission Requirements	none				
Recommended Previous	Basic knowledge of physics, chemistry and electrical engi	neering			
Knowledge		C .			
Educational Objectives	After taking part successfully, students have reached the f	ollowing learning results			
Professional Competence		5 5			
Knowledge	Students are able to name the most important fundmenta	als of the Measurement Technology (Quantities a	and Units. Uncertaint	v. Calibration. Static an	
	Dynamic Properties of Sensors and Systems).			,,,,	
	They can outline the most important measuring methods	for different kinds of quantities to be maesured (I	Electrical Quantities,	Temperature, mechanica	
	quantities, Flow, Time, Frequency).				
	They can describe important methods of chemical Analys	is (Gas Sensors, Spectroscopy, Gas Chromatogra	aphy)		
	·····)				
Skills	Students can select suitable measuring methods to given	problems and can use refering measurement de	vices in practice.		
chine .			nooo in praotioo.		
	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 docume	int them in a common report			
Social Competence	Students can arrive at work results in groups and docume	an them in a common report.			
Autonomy	Students are able to familiarize themselves with new mas	auromont to chaple give			
Autonomy	Students are able to familiarize themselves with new mea	surement 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): Specia	lisation Energy and Enviromental Engineering: C	ompulsory		
Curricula	General Engineering Science (German program): Specia				
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory				
	Energy and Environmental Engineering: Core qualificatio	n: Compulsory			
	General Engineering Science (English program): Special	isation Energy and Enviromental Engineering: Co	ompulsory		
	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 semes	ter): Specialisation Energy and Enviromental Eng	jineering: Compulsor	У	
	General Engineering Science (English program, 7 semes	ter): Specialisation Mechanical Engineering: Cor	npulsory		
	General Engineering Science (English program, 7 semes	ter): Specialisation Biomedical Engineering: Con	npulsory		
	General Engineering Science (English program, 7 semes	ter): Specialisation Process Engineering: Compu	lsory		
	Mechanical Engineering: Core qualification: Compulsory				
	Mechatronics: Core qualification: Compulsory				
	Process Engineering: Core gualification: Compulsory				



ourse L1119: Practical Course: Me	easurement and Control Systems
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Wolfgang Schröder
Language	DE
Cycle	WiSe/SoSe
Content	Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants in automotive exhaust are used.
	Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated. The starting will be simulated on a PC and compared with measurement.
	Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michelson interferometer and optical fibers demonstrated.
	Experiment 4:Identification of the parameters of a control system and optimal control parameters
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 BI.1, 2451 BI.4, 2453 BI.5, 2455 BI.1 Versuch 2: Grundlagen über elektrische Maschinen, speziell: Asynchronmotoren Simulationsmethoden, speziell: Verwendung von Blockschaltbildern Betriebsverhalten von Kreispumpen, speziell: Kennlinien, Ähnlichkeitsgesetze Versuch 3: Unger, HG.: Optische Nachrichtentechnik, Teil 1: Optische Wellenleiter. Hüthing Verlag, Heidelberg, 1984 Dakin, J., Cushaw, B.: Optical Fibre Sensors: Principles and Components. Artech House Boston, 1989 Versuch 4: Leonhard: Einführung in die Regelungstechnik. Vieweg Verlag, Braunschweig-Wiesbaden Jan Lunze: Systemtheoretische Grundlagen, Analyse und Entwurf einschleitiger Regelungen



	Lecture		
	2		
-	3		
	Independent Study Time 62, Study Time in Lecture 28 Dr. Sven Krause		
	DE		
8 8	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		
	Amplification		
	Oscilloscope		
	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.		

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



Module M0639: Gas and St	eam Power Plants			
Courses				
Title		Тур	Hrs/wk	CP
Gas and Steam Power Plants (L0206)		Lecture	3	4
Gas and Steam Power Plants (L0210)		Recitation Section (large)	2	2
Module Responsible	Prof. Alfons Kather			
Admission Requirements	None			
Recommended Previous				
Knowledge	"Technical Thermodynamics I and II"			
	"Heat Transfer"			
	"Fluid Mechanics"			
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence		•		
Knowledge	The students can evaluate the development of the electricity dema	and and the energy conversion routes	in the thermal power pl	ant, describe the various
Ū	types of power plant and the layout of the steam generator block			
	describe the exhaust gas cleaning apparatus and other environment	mental protection measures, along with	th the combination pos	sibilities of conventiona
	fossil-fuelled power plants and regenerative (solar, wind) power pl	ants or plants equipped with Carbon C	apture and Storage.	
	The students can on a basic level explain principles, operation a	nd design of turbomachinery. They are	able to describe the e	environmental impacts o
	acidification, fine particulate or CO_2 emissions and the resulting of			
	from interconnecting conventional power plants and renewable ϵ			
	supply and network stability, also with economics considered.	shergy sources and can name the op		tor providing security o
Skills	The students are able, using theories and methods of the energy	gy technology from fossil fuels and b	ased on deep knowled	dge on the function and
	construction of gas and steam power plants, to identify basic a	ssociations in the production of heat	and electricity, so as	to develop conceptiona
	solutions. Through analysis of the problem and exposure to the	inherent interconnections between he	eat and power generat	ion, the students will be
	endowed with the capability and methodology to develop realist	tic optimal concepts for the environme	entally benign generati	on of electricity and the
	production of heat. From the technical basics the students becom		rations on the electricit	y mix composition within
	the energy-political triangle (economy, secure supply and environmeters)	mental protection).		
	The students are able to highlight aspects of the design and development of power plant cycles with the specialised software suite EBSIL			
	Professional TM and to independently program simplified power pla	ant process simulations.		
	The students are able to do simplified calculations of turbo machin	ery as either an overall plant or as indi	vidual stages.	
Personal Competence				
Social Competence	The students are able to solve subject-specific exercises in smalls	aroups and can present their common	results orally	
oociai oompetence		groups and can present their common	riesuns orany.	
	The students are able to analyze suitable technical alternatives t	to reduce the environmental and socia	al footprint of their engi	neering activities and to
	support the energy revolution effectively.			
Autonomy	The students assisted by the tutors will be able to develop alone	simple simulation models and run w	ith these scenario anal	yses. In this manner the
	theoretical and practical knowledge from the lecture is consoli			
	conditions highlighted. The students are able to analyse indepe	endently the operational performance	of steam power plants	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 E	nergy and Enviromental Engineering	Compulsorv	
Curricula	General Engineering Science (German program): Specialisation M			
	General Engineering Science (German program, 7 semester): Spe			у
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering, Fo	ocus Energy Systems: E	elective Compulsory
	Energy and Environmental Engineering: Core qualification: Comp			
	General Engineering Science (English program): Specialisation En	nergy and Enviromental Engineering: (Compulsory	
	General Engineering Science (English program): Specialisation M	echanical Engineering, Focus Energy	Systems: Compulsory	
	General Engineering Science (English program, 7 semester): Spec	cialisation Energy and Enviromental Er	ngineering: Compulsory	1
	General Engineering Science (English program, 7 semester): Spec	cialisation Mechanical Engineering, Fo	ocus Energy Systems: E	lective Compulsory
	Mechanical Engineering: Specialisation Energy Systems: Compute	sory		



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	
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
	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
	lecture hall exercise. The challenges in plant operation from interconnecting conventional power plants and renewable energy sources are dis
	and the technical options for providing security of supply and network stability are presented, also under consideration of cost effectiveness
	critical review, focus is especially placed on the compatibility of the different solutions with the environment and climate. With this, the awareness responsibility of an engineer's own actions are emphasized and the potential extent of the different solutions presented clearly.
	רפאטיוזאטוווא טו מון פווקווופר ג טאון מכווטוג מיפ פוויטומגובפט מווט ווופ טטפוועמן פאנפות טו נוופ טוופרפות גטוטוטוג 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
	whole subject field of gas and steam power plants. Through discussions with plant personnel the students are able to obtain an overview
	operation problems and their solution approach.
	This activity binges, however, upon the availability of support financing and as such it cannot always be avarateed
	This activity hinges, however, upon the availability of support financing and as such it cannot always be guaranteed.
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Literature	Kalide: Kraft- und Arbeitsmaschinen
	Thomas, H.J.: Thermische Kraftanlagen. Springer-Verlag, 1985
	Strauß, K.: Kraftwerkstechnik. Springer-Verlag, 2006
	Kugeler und Phlippen: Energietechnik. Springer-Verlag, 1990
	T. Bohn (Hrsg.): Handbuchreihe Energie, Band 7: Gasturbinenkraftwerke, Kombikraftwerke, Heizkraftwerke und Industriekraftwerke, Tech
	Verlag Resch / Verlag TÜV Rheinland



Course L0210: Gas and Steam Powe	er Plants
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	
Lecturer	Independent Study Time 32, Study Time in Lecture 28 Prof. Alfons Kather
Language Cycle	
0	
Content	In the 1 st part of the lecture a general introduction into fluid-flow machines and steam power plants is offered, including:
	Energy balance of a fluid-flow machine
	Theory of turbine and compressor stage
	Equal and positive pressure blading
	Flow losses
	Characteristic numbers
	Axial and radial design
	Design features
	Hydraulic fluid-flow machines
	Pump and water turbine designs
	Design examples of reciprocating engines and turbomachinery
	Steam power plants
	Gas turbine systems
	Diesel engine systems
	Waste heat utilisation
	followed by the more specialised issues:
	Electricity Demand and Forecasting
	Thermodynamic fundamentals
	Energy Conversion in Thermal Power Plants
	Types of Power Plant
	Layout of the power plant block
	Individual elements of the power plant
	Cooling systems
	Flue gas cleaning
	Operation characteristics of the power plant
	Construction materials
	Location of power plants
	The environmental impact of acidification, fine particulate or CO ₂ emissions and the resulting climatic effects are a special focus of the lecture and the
	lecture hall exercise. The challenges in plant operation from interconnecting conventional power plants and renewable energy sources are discussed
	and the technical options for providing security of supply and network stability are presented, also under consideration of cost effectiveness. In this
	critical review, focus is especially placed on the compatibility of the different solutions with the environment and climate. With this, the awareness for the
	responsibility of an engineer's own actions are emphasized and the potential extent of the different solutions presented clearly.
	Within the framework of the exercise the students learn the use of the specialised software suite EBSILON Professional TM . With this tool small tasks are
	solved on the PC, to highlight aspects of the design and development of power plant cycles. The students present their results orally and can afterwards
	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, Technischer
	Verlag Resch / Verlag TÜV Rheinland
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	tals of Materials Science			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Materials Science I (L10	85)	Lecture	2	2
-undamentals of Materials Science II (Ad-	vanced Ceramic Materials, Polymers and Composites) (L0506)	Lecture	2	2
Physical and Chemical Basics of Materials	Science (L1095)	Lecture	2	2
Module Responsible	Prof. Jörg Weißmüller			
Admission Requirements	None			
Recommended Previous	Highschool-level physics, chemistry und mathematics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	The students have acquired a fundamental knowledge on Fundamental knowledge here means specifically the issues o mechanical properties. The students know about the key asp characterizing specific properties. They are able to trace materi	f atomic structure, microstructure, ph pects of characterization methods for	nase diagrams, phase transfo or materials and can identify r	rmations, corrosion relevant approache
Skills	The students are able to trace materials phenomena back to t mechanical properties such as strength, ductility, and stiffness solidification, precipitation, or melting. The students can expla can account for the impact of microstructure on the material's b	, chemical properties such as corros in the relation between processing of	sion resistance, and to phase	transformations suc
Personal Competence				
Personal Competence	-			
Social Competence	-			
Social Competence Autonomy	- - Independent Study Time 96, Study Time in Lecture 84			
Social Competence Autonomy Workload in Hours	- - Independent Study Time 96, Study Time in Lecture 84			
Social Competence Autonomy Workload in Hours Credit points	6			
Social Competence Autonomy Workload in Hours Credit points Examination	6 Written exam			
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	6 Written exam 180 min			
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisatic	•••		
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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

Түр	Lecture
Hrs/wk	
CP	2
	Independent Study Time 32, Study Time in Lecture 28
	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 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 M1275: Environme	ntal Technology			
Courses				
Title		Тур	Hrs/wk	CP
Practical Exercise Environmental Techno	logy (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	g learning results		
Professional Competence				
Knowledge	With the completion of this modul the students obtain profound	d knowledge of environmental technolo	ogy. 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 relate
	methods.			
01.11			bland Theorem able to	and a transfer of the state of the sector
Skills	Students are able to propose appropriate management and mit			-
	parameters and to assess the potential of pollutants to migra			
	Environmental Technology contributes to sustainable development	ent, and they can present and defend the	ese opinons in front of a	ind against the group.
Personal Competence				
Social Competence	The students are able to discuss the various technical and scier	tific tasks, both subject-specific and mu	Iltidisciplinary. They are	able to develop differer
	approaches to the task as a group as well as to discuss their theoretical or practical implementation.			
A (1)		and the theory of the base of the data and the		
Autonomy	Students can independently exploit sources about of the subject	acquire the particular knowledge and t	ranter 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	Energy and Enviromental Engineering:	: Compulsory	
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): S	pecialisation Energy and Enviromental I	Engineering: Compulso	ry
	General Engineering Science (German program, 7 semester): S	pecialisation Process Engineering: Elec	tive Compulsory	
	General Engineering Science (German program, 7 semester): S	pecialisation Bioprocess Engineering: E	lective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsor	1		
	Energy and Environmental Engineering: Core qualification: Com	pulsory		
	General Engineering Science (English program): Specialisation	Energy and Enviromental Engineering:	Compulsory	
	General Engineering Science (English program): Specialisation	Process Engineering: Elective Compuls	sory	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Energy and Enviromental E	Engineering: Compulsor	у
	General Engineering Science (English program, 7 semester): Sp	ecialisation Process Engineering: Elect	ive Compulsory	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Bioprocess Engineering: El	ective Compulsory	
	Process Engineering: Core qualification: Elective Compulsory			
	1			

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



Module M0670: Particle Tec	chnology and Solids Process Enginee	ring		
Courses				
Title		Тур	Hrs/wk	CP
Particle Technology I (L0434)		Lecture	2	3
Particle Technology I (L0435)		Recitation Section (small)	1	1
Particle Technology I (L0440)		Laboratory Course	2	2
Module Responsible	Prof. Stefan Heinrich			
Admission Requirements	None			
Recommended Previous	keine			
Knowledge				
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	After successful completion of the module students a	ire able to		
	 name and explain processes and unit-opera 	tions of solids process engineering.		
	characterize particles, particle distributions a			
Skills	Students are able to			
	 choose and design apparatuses and process 	ses for solids processing according to the desired solid	s properties of the pr	oduct
	 asses solids with respect to their behavior in 	solids processing steps		
	 document their work scientifically. 			
Personal Competence				
Social Competence		Ily with other students or scientific personal and to dev	elop solutions for teo	hnical-scientific issues
	a group.			
Autonomy		70		
Workload in Hours	Independent Study Time 110, Study Time in Lecture	70		
Credit points Examination	6 Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Sp			
Curricula	General Engineering Science (German program): Sp			
		pecialisation Energy and Enviromental Engineering: Co		
		emester): Specialisation Process Engineering: Compu		
		emester): Specialisation Bioprocess Engineering: Con emester): Specialisation Energy and Enviromental Eng		n/
	Bioprocess Engineering: Core qualification: Comput		Jineening. Compuiso	y
	Energy and Environmental Engineering: Core qualif	•		
	General Engineering Science (English program): Sp			
		ecialisation Energy and Enviromental Engineering: Co	mpulsorv	
	General Engineering Science (English program): Sp			
		emester): Specialisation Process Engineering: Comput	sory	
		emester): Specialisation Bioprocess Engineering: Comparent	•	
		emester): Specialisation Energy and Enviromental Eng		y
	Process Engineering: Core qualification: Compulsor		3 ,,	



Course L0434: Particle Technology	1
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	I
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	 Sieving Bulk properties Size reduction Mixing Gas cyclone Blaine-test, filtration Sedimentation
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.



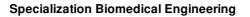
Module M1274: Environme	ntal Technology					
Courses						
Title		Тур	Hrs/wk	CP		
Environmental Assessment (L0860)		Lecture	2	2		
Environmental Assessment (L1054)		Recitation Section (small)	1	1		
Module Responsible	Prof. Martin Kaltschmitt					
· ·	None					
Admission Requirements						
Recommended Previous Knowledge	Fundamentals of inorganic/organic chemistry and biology					
Educational Objectives	After taking part successfully, students have reached the fol	lowing learning results				
Professional Competence						
Knowledge	With the completion of this module the students acquire in-depth knowledge of important cause-effect chains of potential environmental problem					
	might occur from production processes, projects or constru	ction measures. They have knowledge about	the methodological di	iversity and are compe		
	in dealing with different methods and instruments to asses		nts are able to estima	te the complexity of the		
	environmental processes as well as uncertainties and difficulties with their measurement.					
Skills	The students are able to select a suitable method for the	respective case from the variety of assessme	nt methods. Thereby	they can develop suita		
	solutions for managing and mitigating environmental pro-	oblems in a business context. They are abl	e to carry out Life C	ycle Impact Assessme		
	independently and can apply the software programs OpenLCA and the database Ecolnvent. After finishing the course the students have the competence					
	to critically judge research results or other publications on e	environmental impacts.				
Personal Competence						
Social Competence	The students are able to discuss the various technical an	d scientific tasks, both subject specific and m	ultidicciplinary Thou	ara abla ta davalan iai		
Social Competence	The students are able to discuss the various technical and					
	different solutions and to discuss their theoretical or practical implementation. Due to the selected lecture topics, the students receive insights into the multi-layered issues of the environment protection and the concept of sustainability. Their sensitivity and consciousness towards these subjects a					
	raised and which helps to raise their awareness of their futu			wards these subjects		
Autonomy	The students learn to research, process and present a scientific topic independently. They are able to carry out independent scientific work. T solve an environmental problem in a business context and are able to judge results of other publications.					
Weyldeed in Usyn						
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42					
Credit points	3					
Examination	Written exam					
Examination duration and scale	1 hour written exam					
Assignment for the Following	General Engineering Science (German program): Specialis					
Curricula	General Engineering Science (German program): Specialis					
	General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory					
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Elective Compulsory					
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Elective Compulsory					
	Bioprocess Engineering: Core qualification: Elective Compulsory					
	Energy and Environmental Engineering: Core qualification	Compulsory				
	General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory					
	General Engineering Science (English program): Specialisation Process Engineering: Elective Compulsory					
	General Engineering Science (English program, 7 semeste	r): Specialisation Energy and Enviromental E	ngineering: Compulso	ry		
	General Engineering Science (English program, 7 semeste	r): Specialisation Process Engineering: Electi	ve Compulsory			
	General Engineering Science (English program, 7 semeste	r): Specialisation Bioprocess Engineering: Ele	ective Compulsory			
	Process Engineering: Core qualification: Elective Compulse	ory				
	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

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Module M0933: Fundamen	tals of Materials Science					
Courses						
Title		Тур	Hrs/wk	CP		
Fundamentals of Materials Science I (L10	85)	Lecture	2	2		
Fundamentals of Materials Science II (Advanced Ceramic Materials, Polymers and Composites) (L0506)		Lecture	2	2		
Physical and Chemical Basics of Materials	Science (L1095)	Lecture	2	2		
Module Responsible	Prof. Jörg Weißmüller					
Admission Requirements	None					
Recommended Previous Knowledge	Highschool-level physics, chemistry und mathematics					
Educational Objectives	After taking part successfully, students have reached the following	ng learning results				
Professional Competence						
Knowledge	The students have acquired a fundamental knowledge on metals, ceramics and polymers and can describe this knowledge comprehensive Fundamental knowledge here means specifically the issues of atomic structure, microstructure, phase diagrams, phase transformations, corrosion and mechanical properties. The students know about the key aspects of characterization methods for materials and can identify relevant approaches to characterizing specific properties. They are able to trace materials phenomena back to the underlying physical and chemical laws of nature.					
Skills	The students are able to trace materials phenomena back to the underlying physical and chemical laws of nature. Materials phenomena here refers mechanical properties such as strength, ductility, and stiffness, chemical properties such as corrosion resistance, and to phase transformations such a solidification, precipitation, or melting. The students can explain the relation between processing conditions and the materials microstructure, and the can account for the impact of microstructure on the material's behavior.					
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		n Energy and Enviromental Engineer	ing: Compulsory			
Curricula						
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory					
	General Engineering Science (German program): Specialisation	n Naval Architecture: Compulsory				
	General Engineering Science (German program, 7 semester): S	Specialisation Mechanical Engineerin	g: Compulsory			
	General Engineering Science (German program, 7 semester): S	Specialisation Biomedical Engineering	g: Compulsory			
	General Engineering Science (German program, 7 semester): S					
	General Engineering Science (German program, 7 semester): S		tal Engineering: Compulsor	у		
	Energy and Environmental Engineering: Core qualification: Compulsory					
	General Engineering Science (English program): Specialisation	n Energy and Enviromental Engineeri				
	General Engineering Science (English program): Specialisation	n Energy and Enviromental Engineeri n Mechanical Engineering: Compulso	ry			
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	n Energy and Enviromental Engineeri n Mechanical Engineering: Compulso n Biomedical Engineering: Compulso	ry			
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	n Benergy and Enviromental Engineeri n Mechanical Engineering: Compulso n Biomedical Engineering: Compulson n Naval Architecture: Compulsory	ry ry			
	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	n Energy and Enviromental Engineeri Nechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory pecialisation Mechanical Engineering	ry ry g: Compulsory			
	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 General Engineering Science (English program, 7 semester): S	n Energy and Enviromental Engineeri Mechanical Engineering: Compulso n Biomedical Engineering: Compulso n Naval Architecture: Compulsory pecialisation Mechanical Engineering pecialisation Biomedical Engineering	ry ry g: Compulsory j: Compulsory			
	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	n Energy and Enviromental Engineeri Mechanical Engineering: Compulso a Biomedical Engineering: Compulso a Naval Architecture: Compulsory pecialisation Mechanical Engineering pecialisation Biomedical Engineering pecialisation Naval Architecture: Com	ry ry g: Compulsory g: Compulsory ipulsory	,		
	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 General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S	a Energy and Enviromental Engineeri Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory pecialisation Mechanical Engineering pecialisation Biomedical Engineering pecialisation Naval Architecture: Com pecialisation Energy and Enviroment	ry ry g: Compulsory g: Compulsory ipulsory	,		
	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 General Engineering Science (English program, 7 semester): S	a Energy and Enviromental Engineeri Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory pecialisation Mechanical Engineering pecialisation Biomedical Engineering pecialisation Naval Architecture: Com pecialisation Energy and Enviroment	ry ry g: Compulsory g: Compulsory ipulsory	, ,		
	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 General Engineering Science (English program, 7 semester): S Logistics and Mobility: Specialisation Engineering Science: Elec	a Energy and Enviromental Engineeri Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory pecialisation Mechanical Engineering pecialisation Biomedical Engineering pecialisation Naval Architecture: Com pecialisation Energy and Enviroment	ry ry g: Compulsory g: Compulsory ipulsory	,		
	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 General Engineering Science (English program, 7 semester): S Logistics and Mobility: Specialisation Engineering Science: Elec Mechanical Engineering: Core qualification: Compulsory	a Energy and Enviromental Engineeri Mechanical Engineering: Compulso Biomedical Engineering: Compulso Naval Architecture: Compulsory pecialisation Mechanical Engineering pecialisation Biomedical Engineering pecialisation Naval Architecture: Com pecialisation Energy and Enviroment	ry ry g: Compulsory g: Compulsory ipulsory	, ,		



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

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

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



Module M0634: Introductio	n into Medical Technology and Systems			
Courses				
Title		Тур	Hrs/wk	CP
Introduction into Medical Technology and	Systems (10342)	Lecture	2	3
Introduction into Medical Technology and		Problem-based Learning	4	3
Module Responsible	Prof. Alexander Schlaefer			
Admission Requirements	none			
Recommended Previous	principles of math (algebra, analysis/calculus)			
Knowledge	principles of stochastics			
Knowledge	principles of programming, R/Matlab			
	principles of programming, rivitatian			
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	The students can explain medical technology and its princip	les, including imaging systems, computer a	ided surgery, medical	sensor systems, medica
	information systems. They are able to give an overview of reg	ulatory affairs and standards in medical tech	inology.	
01.11	The students construction of a determinant of the state o			
Skills	The students are able to apply principles of medical technolog	gy to solving actual problems.		
Personal Competence				
Social Competence	The students describe a problem in medical technology as a p	project, and define tasks that are solved in a	joint effort.	
Autonomy	The students can reflect their knowledge and document the re	esults of their work. They can present the res	ults 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): Specialisat	ion Biomedical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester)	: Specialisation Biomedical Engineering: Co	ompulsory	
	Computer Science: Specialisation Computer and Software Er	gineering: Elective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsor	ry		
	General Engineering Science (English program): Specialisati	on Biomedical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester):	Specialisation Biomedical Engineering: Co	mpulsory	
	Computational Science and Engineering: Specialisation Engi	neering Sciences: Elective Compulsory		
	Computational Science and Engineering: Specialisation Com	puter Science: Elective Compulsory		
	Biomedical Engineering: Specialisation Artificial Organs and	Regenerative Medicine: Elective Compulsor	у	
	Biomedical Engineering: Specialisation Implants and Endopre	ostheses: Elective Compulsory		
	Biomedical Engineering: Specialisation Medical Technology	and Control Theory: Elective Compulsory		
	Biomedical Engineering: Specialisation Management and Bu	siness Administration: Elective Compulsory		
	Technomathematics: Specialisation III. Engineering Science:	Elective Compulsory		

Course L0342: Introduction into Medical Technology and Systems		
Тур	cture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Alexander Schlaefer	
Language	DE	
Cycle	SoSe	
Content	- imaging systems	
	- computer aided surgery	
	- medical sensor systems	
	- medical information systems	
	- regulatory affairs	
	- standard in medical technology	
	The students will work in groups to apply the methods introduced during the lecture using problem based learning.	
Literature	Wird in der Veranstaltung bekannt gegeben.	



Course L0343: Introduction into Medical Technology and Systems		
Тур	Problem-based Learning	
Hrs/wk	4	
CP	3	
Workload in Hours	Independent Study Time 34, Study Time in Lecture 56	
Lecturer	Prof. Alexander Schlaefer	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Courses	
ïtle	Typ Hrs/wk CP
ignals and Systems (L0432)	Leture 3 4
ignals and Systems (L0433)	Recitation Section (large) 1 2
Module Responsible	Prof. Gerhard Bauch
Admission Requirements	None
Recommended Previous	Mathematics 1-3
Knowledge	
	The modul is an introduction to the theory of signals and systems. Good knowledge in maths as covered by the moduls 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	They arising part consection () obtained that is for one time to construct reaction
	The students are able to classify and describe signals and linear time-invariant (LTI) systems using methods of signal and system theory. They a
Nilowieuge	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse deterministic
	and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image domain wh
	caused by the transition of a continuous-time signal to a discrete-time signal.
Skille	The students are able to describe and analyse deterministic signals and linear time-invariant systems using methods of signal and system theor
Skiiis	can analyse and design basic systems regarding important properties such as magnitude and phase response, stability, linearity etc They can
	the impact of LTI systems on the signal properties in time and frequency domain.
Personal Competence	ure mipactor cir systems on the signal properties in time and requercy domain.
	The students are identicate enough problems
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 period by solving tutorial problems, software tools, clicker system
	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 Sc
	Compulsory
	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 Engin
	Compulsory
	Computer Science: Core qualification: Compulsory
	Electrical Engineering: Core qualification: Compulsory
	General Engineering Science (English program): Specialisation Civil- and Enviromental Engeneering: Compulsory
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Computer Science: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation 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: Comp
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sc
	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 Engin
	Compulsory
	Computational Science and Engineering: Core qualification: Compulsory



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

Course L0433: Signals and Systems	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 M0680: Fluid Dyna	mice			
	mics			
Courses				
Title		Тур	Hrs/wk	CP
Fluid Mechanics (L0454)		Lecture	3	4
Fluid Mechanics (L0455)		Recitation Section (large)	2	2
Module Responsible	Prof. Thomas Rung			
Admission Requirements	none			
Recommended Previous	Sound knowledge of engineering mathematics, engineering mechanics and thermodynamics.			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follo	wing learning results		
Professional Competence				
Knowledge	Students will have the required sound knowledge to explain	the general principles of fluid engineering a	nd physics of fluids. S	Students can scientifica
Ũ	outline the rationale of flow physics using mathematical mo			
	engineering devices.		-	·
Skills	Students are able to apply fluid-engineering principles and fl			re enables the studen
	carry out all necessary theoretical calculations for the fluid dy	namic design of engineering devices on a sci	entific level.	
Personal Competence				
Social Competence	The students are able to discuss problems and jointly develo	p solution strategies.		
Autonomy	The students are able to develop solution strategies for comp	lex problems self-consistent and crtically ana	vse results	
hatonomy		iex problems sen consistent and choarry and		
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): 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: Co	mpulsory	
	General Engineering Science (German program, 7 semester)	: Specialisation Biomedical Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester)	: Specialisation Naval Architecture: Compulse	ory	
	General Engineering Science (English program): Specialisat	ion Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisat	ion Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisat	ion Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 semester)	: Specialisation Mechanical Engineering: Cor	npulsory	
	General Engineering Science (English program, 7 semester)	: Specialisation Biomedical Engineering: Con	pulsory	
	General Engineering Science (English program, 7 semester)	: Specialisation Naval Architecture: Compulso	iry	
	Computational Science and Engineering: Specialisation Eng	ineering Sciences: Elective Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science:	Flasting Computers		

Course L0454: Fluid Mechanics		
Тур	ecture	
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 M0960: Mechanics	IV (Kinetics II, Oscillations, Analytical Mecha	inics, Multibody Systems)		
Courses				
litle		Тур	Hrs/wk	CP
Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) (L1137)		Lecture	3	3
Achanics IV (Kinetics II, Oscillations, An	alytical Mechanics, Multibody Systems) (L1138)	Recitation Section (small)	2	2
Achanics IV (Kinetics II, Oscillations, An	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 foll	owing learning results		
Professional Competence				
	The students can			
-				
	 describe the axiomatic procedure used in mechanica 	Il contexts;		
	 explain important steps in model design; 			
	 present technical knowledge. 			
Skills	The students can			
	explain the important elements of mathematical / me	chanical 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 a 	nd 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	overcome difficulties.		
Autonomy	Students are earable of determining their own strengths and	weaknesses and to organize their time and lo	arning based on the	
Autonomy	Students are capable of determining their own strengths and	i weaknesses and to organize their time and le	aming 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): Specialis	ation Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialis			
	General Engineering Science (German program): Specialis			
	General Engineering Science (German program, 7 semeste		noulsorv	
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program, 7 semester		npulsory	
	General Engineering Science (English program, 7 semester			
	General Engineering Science (English program, 7 semester			
	Mechanical Engineering: Core qualification: Compulsory		-	
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science	: Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsor			
	Theoretical Mechanical Engineering: Technical Complement			

Course L1137: Mechanics IV (Kineti	ourse 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	ics II, Oscillations, Analytical Mechanics, Multibody Systems)
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Robert Seifried
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course
Course L1139: Mechanics IV (Kineti	ics II, Oscillations, Analytical Mechanics, Multibody Systems)
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Robert Seifried
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M1277: MED I: Intro	duction to Anatomy			
Courses				
litle		Тур	Hrs/wk	CP
ntroduction to Anatomy (L0384)		Lecture	2	3
Module Responsible	Prof. Udo Schumacher			-
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ed the following learning results		
Professional Competence				
Knowledge				
U U	The students can describe			
	basal structures and functions of internal organs a	nd the musculoskeletal system		
	The students can describe the basic macroscopy a	and microscopy of nose systems.		
Skills	The students can recognize the relationship betw	een given anatomical facts and the development of	common diseases; they c	an explain the relevan
	of structures and their functions in the context of w	idespread diseases.		
Personal Competence				
Social Competence	The students can participate in current discussion	s in biomedical research and medicine on a profess	ional level	
oolar oompetenee				
Autonomy	The students are able to access anatomical know	owledge by themselves, can participate competen	tly in conversations on th	ne topic and acquire the
	relevant knowledge themselves.			
Workload in Hours	Independent Study Time 62, Study Time in Lecture	a 28		
Credit points	3			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following		Specialisation Mechanical Engineering, Focus Bion	nechanics: Compulsory	
Curricula		Specialisation Biomedical Engineering: Compulsor		
		7 semester): Specialisation Biomedical Engineering	•	
		7 semester): Specialisation Mechanical Engineering		ompulsory
	Electrical Engineering: Specialisation Medical Tec	, ,	,,	
		Specialisation Mechanical Engineering, Focus Biom	echanics: Compulsory	
		Specialisation Biomedical Engineering: Compulsory		
		semester): Specialisation Mechanical Engineering.		mpulcon
				mpulsory
	Mechanical Engineering: Specialisation Biomecha	' semester): Specialisation Biomedical Engineering:	Compulsory	
	• • •			
	• • •	echnology and Control Theory: Elective Compulsor		
		nent and Business Administration: Elective Compuls	-	
		Organs and Regenerative Medicine: Elective Compu	ISOTY	
	Biomedical Engineering: Specialisation Implants a			
	Technomathematics: Specialisation III. Engineerin	ig Science: Elective Compulsory		



Course L0384: Introduction to Anatomy		
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		
Contra	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	



Courses				
Title		Тур	Hrs/wk	CP
ntroduction to Radiology and Radiation Th	erapy (L0383)	Lecture	2	3
Module Responsible	Prof. Ulrich Carl			
Admission Requirements	None			
Recommended Previous Knowledge	None			
Educational Objectives	After taking part successfully, students have reache	d the following learning results		
Professional Competence				
Knowledge				
	Therapy			
	The students can distinguish different types of curre	ently used equipment with respect to its use in radi	ation therapy.	
	The students can explain complex treatment plans	used in radiation therapy in interdisciplinary conte	exts (e.g. surgery, internal me	edicine).
	The students can describe the patients' passage fro	om their initial admittance through to follow-up care	э.	
	Diagnostics			
	-			
	The students can illustrate the technical base co imaging techniques (CT, MRT, US).	ncepts of projection radiography, including ang	iography and mammograpi	ny, as well as section
	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 metho	d depending on the patient's clinical history and n	eeds.	
	The student can explain the influence of technical e	errors on the imaging techniques.		
	The student can draw the right conclusions based of	on the images' diagnostic findings or the error prot	ocol	
Skills	Therapy			
	The students can distinguish curative and palliative	sidulions and motivate why they came to that con	iciusion.	
	The students can develop adequate therapy conce	pts and relate it to the radiation biological aspects		
	The students can use the therapeutic principle (effe	cts vs adverse effects)		
	The students can distinguish different kinds of rac energy needed in that situation (irradiation plannin		he situation (location of the	tumor) and choose t
	The student can assess what an individual psycho social services, psycho-oncology).	social service should look like (e.g. follow-up trea	atment, sports, social help g	roups, self-help group
	Diagnostics			
	The students can suggest solutions for repairs of in	agoing instrumentation after having done error and	alvses.	
	The students can classify results of imaging techni			anatamy nathalagy a
	pathophysiology.	ques according to different groups of diseases ba	ased on their knowledge of	anatomy, patrology a
Personal Competence				
Social Competence				
	The students can assess the special social situation	n of tumor patients and interact with them in a prof	essional way.	
	The students are aware of the special, often fear-do	pminated behavior of sick people caused by diagr	nostic and therapeutic meas	ures and can meet the
	appropriately.			
Autonomy				
	The students can apply their new knowledge and s	kills to a concrete therapy case.		
	The students can introduce younger students to the	clinical daily routine.		
	The students are able to access anatomical kno	wledge by themselves, can participate compete	ntly in conversations on the	e 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	Neuristication March 1997 - 1997 - 1997 - 1997	markening Oraci I	
Assignment for the Following Curricula	General Engineering Science (German program): 5 General Engineering Science (German program): 5			
	General Engineering Science (German program, 7			
	General Engineering Science (German program, 7		g, Focus Biomechanics: Co	npulsory
	Electrical Engineering: Specialisation Medical Tech General Engineering Science (English program): S		mechanics: Compulsory	
	General Engineering Science (English program): S			
	General Engineering Science (English program, 7			npulsory
	General Engineering Science (English program, 7	semester): Specialisation Biomedical Engineering	: Compulsory	

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



Mechanical Engineering: Specialisation Biomechanics: Compulsory Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory Technomathematics: Specialisation III. Engineering. Science: Elective Compulsory

Course L0383: Introduction to Radio	ology and Radiation Therapy
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	
Lecturer	Prof. Ulrich Carl, Prof. Thomas Vestring
Language	
Cycle	SoSe The students will be given an understanding of the technological possibilities in the field of medical imaging, interventional radiology and radiation therapy/radiation oncology. It is assumed, that students in the beginning of the course have heard the word "X-ray" at best. It will be distinguished between the two arms of diagnostic (Prof. Dr. med. Thomas Vestring) and therapeutic (Prof. Dr. med. Ulrich Carl) use of X-rays. Both arms depend on special big units, which determine a predefined sequence in their respective departments
Literature	"Technik der medizinischen Radiologie" von T. + J. Laubenberg –
	7. Auflage – Deutscher Ärzteverlag – erschienen 1999
	"Klinische Strahlenbiologie" von Th. Herrmann, M. Baumann und W. Dörr –
	4. Auflage - Verlag Urban & Fischer – erschienen 02.03.2006
	ISBN: 978-3-437-23960-1
	"Strahlentherapie und Onkologie 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			
	- Liginocring. 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	 Evadementals of Machanical Environmics Design 			
Knowledge	 Fundamentals of Mechanical Engineering Design 			
	Mechanics			
	 Fundamentals of Materials Science 			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the following lea	rning results		
	Alter taking part successiony, students have reached the following rea	Thing results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	 explain design guidelines for machinery parts e.g. considering 	load situation, materials and manu	afacturing requirements.	
	 describe basics of 3D CAD, 	encerter, materiale and mane		
	 explain basics methods of engineering designing. 			
	• explain basics methods of engineering designing.			
Skills	After passing the module, students are able to:			
	 independently create sketches, technical drawings and docum 			
	 design components based on design guidelines autonomously 	у,		
	 dimension (calculate) used components, 			
	 use methods to design and solve engineering design tasks system 	stamtically 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 an 	d documenting decisions.		
	 moderate the use of scientific methods, 			
	 present and discuss solutions and technical drawings within g 	roups		
	 reflect the own results in the work groups of the course. 	, oups,		
	 Tellect the own results in the work groups of the course. 			
Autonomy	Students are able			
	 to estimate their level of knowledge using activating methods 	within the lectures (e.g. with clicker	rs),	
	 To solve engineering design tasks systematically. 			
Worklood in Hours	Independent Study Time 40, Study Time in Leature 140			
Workload in Hours	Independent Study Time 40, Study Time in Lecture 140			
Credit points				
Examination	Written exam			
Examination duration and scale	180			
Assignment for the Following	General Engineering Science (German program): Specialisation Ener	gy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specialisation Mech	nanical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Biom	nedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Special	lisation Mechanical Engineering: C	ompulsory	
	General Engineering Science (German program, 7 semester): Special	lisation Biomedical Engineering: Co	ompulsory	
	General Engineering Science (German program, 7 semester): Specia	lisation Energy and Enviromental E	ngineering: Compulsor	у
	Energy and Environmental Engineering: Core qualification: Compulso			-
	General Engineering Science (English program): Specialisation Energy		Compulsory	
	General Engineering Science (English program): Specialisation Mech			
	General Engineering Science (English program): Specialisation Nech			
			ompulsory	
	General Engineering Science (English program, 7 semester): Special			
	General Engineering Science (English program, 7 semester): Special			
	General Engineering Science (English program, 7 semester): Special	isation Energy and Enviromental El	ngmeering: Compulsory	1
	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
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause
Language	DE
Cycle	WiSe
Content	 Basics of 3D CAD technology Practical course to apply a 3D CAD system Introduction to the system Sketching and creation of components Creation of assemblies Deriving technical drawings
Literature	 CAx für Ingenieure eine praxisbezogene Einführung; Vajna, S., Weber, C., Bley, H., Zeman, K.; Springer-Verlag, aktuelle Auflage. Handbuch Konstruktion; Rieg, F., Steinhilper, R.; Hanser; aktuelle Auflage. Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Technisches Zeichnen: Grundlagen, Normen, Beispiele, Darstellende Geometrie, Hoischen, H; Hesser, W; Cornelsen, aktuelle Auflage. Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage. Maschinen- und Konstruktionslehmente; 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
CP	2
Workload in Hours	Independent Study Time 18, Study Time in Lecture 42
Lecturer	Prof. Wolfgang Hintze
Language	DE
Cycle	SoSe
Content	 Generation of sketches for functions and sub-functions Approximately calculation of shafts Dimension of bearings, screw connections and weld Generation of engineering drawings (assembly drawings, manufacturing drawing)
Literature	Dubbel, Taschenbuch für Maschinenbau, Beitz, W., Küttner, KH, Springer-Verlag. Maschinenelemente, Band I - III, Niemann, G., Springer-Verlag. Maschinen- und Konstruktionselemente, Steinhilper, W., Röper, R., Springer-Verlag. Einführung in die DIN-Normen, Klein, M., Teubner-Verlag. Konstruktionslehre, Pahl, G., Beitz, W., Springer-Verlag.

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



Module M0646: BIO I: Impla	nts and Testing			
2011/2020				
Courses		Tur	Unabula	0.0
Fitle	0.771	Тур	Hrs/wk	СР 3
Experimental Methods in Biomechanics (L mplants and Fracture Healing (L0376)	0377)	Lecture	2	3
Module Responsible	Prof. Michael Morlock	Lootaro	L	0
Admission Requirements	None			
Recommended Previous			Matha da a "	
Knowledge	It is recommended to participate in "Implantate und Frakturheilu	ig before allending Experimentelle	welhoden .	
0				
Educational Objectives	After taking part successfully, students have reached the following	ig learning results		
Professional Competence				
Knowledge	The students can describe the different ways how bones heal, a	nd the requirements for their existence	e.	
	The students can name different treatments for the spine and ho	llow bones under given fracture morp	bhologies.	
	The students can describe different measurement techniques for	r forces and movements, and choose	the adequate technique for	a given task.
Skills	The students can determine the forces acting within the human	oody under quasi-static situations un	der specific assumptions.	
	The students can describe the basic handling of several experir	nental techniques used in biomechar	nics.	
Personal Competence				
Social Competence	The students can, in groups, solve basic experimental tasks.			
Autonomy	The students can, in groups, solve basic experimental tasks.			
Workload in Hours	Independent Study Time 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	Mechanical Engineering, Focus Bio	mechanics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation	Biomedical Engineering: Compulso	ry	
	General Engineering Science (German program, 7 semester): S	pecialisation Mechanical Engineerin	g, Focus Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): S	pecialisation Biomedical Engineering	g: Compulsory	
	General Engineering Science (English program): Specialisation	Biomedical Engineering: Compulsor	γ	
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Bior	nechanics: Compulsory	
	General Engineering Science (English program, 7 semester): S			npulsory
	General Engineering Science (English program, 7 semester): S			
	Mechanical Engineering: Specialisation Biomechanics: Compu		i comparcery	
	Biomedical Engineering: Specialisation Biomedical Organs and Re	•	ulsory	
	Biomedical Engineering: Specialisation Anticial Organs and Re Biomedical Engineering: Specialisation Implants and Endopros		aloory	
			n	
	Biomedical Engineering: Specialisation Medical Technology an		•	
	Biomedical Engineering: Specialisation Management and Busin		sory	
	Technomathematics: Specialisation III. Engineering Science: El			

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



-	re Healing
Typ Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Michael Morlock
Language	DE
Cycle	WiSe Training the second state of the second s
Content	Topics to be covered include:
	1. Introduction (history, definitions, background importance)
	2. Bone (anatomy, properties, biology, adaptations in femur, tibia, humerus, radius)
	3. Spine (anatomy, biomechanics, function, vertebral bodies, intervertebral disc, ligaments)
	3.1 The spine in its entirety
	3.2 Cervical spine
	3.3 Thoracic spine
	3.4 Lumbar spine
	3.5 Injuries and diseases
	4. Pelvis (anatomy, biomechanics, fracture treatment)
	5 Fracture Healing
	5.1 Basics and biology of fracture repair
	5.2 Clinical principals and terminology of fracture treatment
	5.3 Biomechanics of fracture treatment
	5.3.1 Screws
	5.3.2 Plates
	5.3.3 Nails
	5.3.4 External fixation devices
	5.3.5 Spine implants
	6.0 New Implants
Literature	Cochran V.B.: 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			
Module M0662: Numerical				
Courses				
Title		Тур	Hrs/wk	CP
Numerical Mathematics I (L0417)		Lecture	2	3
Numerical Mathematics I (L0418)	Dref Cabina La Darra	Recitation Section (small)	2	3
Module Responsible	Prof. Sabine Le Borne			
Admission Requirements Recommended Previous	None			
Knowledge	 Mathematik I + II for Engineering Students (ge basic MATLAB knowledge 	erman or english) or Analysis & Linear Algebra I + II fo	or Technomathematiciar	าร
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	Students are able to			
	explain their core ideas, • repeat convergence statements for the numer			nding problems and
	 explain aspects for the practical execution of r 	numerical methods with respect to computational and	I storage complexitx.	
Skills	Students are able to			
	• implement, apply and compare numerical me	thods using MATLAB,		
	 justify the convergence behaviour of numerical select and execute a suitable solution approate 	al methods with respect to the problem and solution a tch for a given problem.	llgorithm,	
Personal Competence				
Social Competence	Students are able to			
		I teams (i.e., teams from different study programs an tical aspects regarding the implementation of algorith		ge), explain theoreti
Autonomy	Students are capable			
	 to assess whether the supporting theoretical a 	and practical excercises are better solved individually	or in a team,	
	• to assess their individual progess and, if nece	essary, to ask questions and seek help.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 5	56		
Credit points				
Examination	Written exam			
Examination duration and scale	90 minutes			
		ecialisation Computer Science: Compulsory		
Examination duration and scale	90 minutes General Engineering Science (German program): Sp		nanics: Compulsory	
Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Sp General Engineering Science (German program): Sp			es: Compulsory
Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program): Sp	ecialisation Mechanical Engineering, Focus Biomech ecialisation Mechanical Engineering, Focus Materials ecialisation Biomedical Engineering: Compulsory	s in Engineering Scienc	es: Compulsory
Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Sp General Engineering Science (German program, 7 sc	ecialisation Mechanical Engineering, Focus Biomech ecialisation Mechanical Engineering, Focus Materials ecialisation Biomedical Engineering: Compulsory emester): Specialisation Computer Science: Compuls	s in Engineering Scienc	
Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program, 7 st General Engineering Science (German program, 7 st General Engineering Science (German program, 7	ecialisation Mechanical Engineering, Focus Biomech ecialisation Mechanical Engineering, Focus Materials ecialisation Biomedical Engineering: Compulsory	s in Engineering Scienc	
Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program, 7 sc General Engineering Science (German program, 7 General Engineering Science (German program, 7	ecialisation Mechanical Engineering, Focus Biomech ecialisation Mechanical Engineering, Focus Materials ecialisation Biomedical Engineering: Compulsory emester): Specialisation Computer Science: Compuls 7 semester): Specialisation Mechanical Engineering	s in Engineering Scienc sory Ig, Focus Materials in	
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Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Sp General Engineering Science (German program, 7 General Engineering Science (German program, 7 Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program, 7 Science (German program)	ecialisation Mechanical Engineering, Focus Biomech vecialisation Mechanical Engineering, Focus Materials vecialisation Biomedical Engineering: Compulsory emester): Specialisation Computer Science: Compuls 7 semester): Specialisation Mechanical Engineering emester): Specialisation Biomedical Engineering: Cor emester): Specialisation Mechanical Engineering. Foc	s in Engineering Scienc sory ig, Focus Materials in mpulsory	Engineering Scienc
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Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Sp General Engineering Science (German program, 7 General Engineering Science (German program, 7 Compulsory General Engineering Science (German program, 7 General Engineering Science (German program, 7 St General Engineering Science (German program, 7 St General Engineering Science (German program, 7 St General Engineering: Specialisation A - General E Computer Science: Specialisation Computational Ma Electrical Engineering: Core qualification: Elective Co	ecialisation Mechanical Engineering, Focus Biomech becialisation Mechanical Engineering, Focus Materials becialisation Biomedical Engineering: Compulsory emester): Specialisation Computer Science: Compuls 7 semester): Specialisation Mechanical Engineering emester): Specialisation Biomedical Engineering: Con emester): Specialisation Mechanical Engineering, Foc Bioprocess Engineering: Elective Compulsory athematics: Elective Compulsory ompulsory ecialisation Computer Science: Compulsory	s in Engineering Scienc sory ig, Focus Materials in mpulsory	Engineering Scienc
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Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program, 7 sc General Engineering: Specialisation A - General E Computer Science: Specialisation Computational Ma Electrical Engineering: Core qualification: Elective Co General Engineering Science (English program): Spe General Engineering Science (English program); Spe General Engineering Science (English program); Spe General Engineering Science (English program); Spe	ecialisation Mechanical Engineering, Focus Biomech becialisation Mechanical Engineering, Focus Materials becialisation Biomedical Engineering: Compulsory emester): Specialisation Computer Science: Compuls 7 semester): Specialisation Mechanical Engineering emester): Specialisation Mechanical Engineering emester): Specialisation Mechanical Engineering, Foc Bioprocess Engineering: Elective Compulsory athematics: Elective Compulsory ecialisation Computer Science: Compulsory ecialisation Biomedical Engineering; Compulsory ecialisation Biomedical Engineering, Focus Biomecha ecialisation Mechanical Engineering, Focus Materials emester): Specialisation Computer Science: Compulsory ecialisation Mechanical Engineering, Focus Materials emester): Specialisation Computer Science: Compulsory ecialisation Mechanical Engineering, Focus Materials emester): Specialisation Mechanical Engineering	s in Engineering Scienc sory g, Focus Materials in mpulsory cus Biomechanics: Con anics: Compulsory s in Engineering Scienc ory g, Focus Materials in	Engineering Scienc
Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program, 7 sc General Engineering: Specialisation A - General E Computer Science: Specialisation Computational Ma Electrical Engineering: Core qualification: Elective Co General Engineering Science (English program): Spe General Engineering Science (English program, 7 se General Engineer	ecialisation Mechanical Engineering, Focus Biomech becialisation Mechanical Engineering, Focus Materials becialisation Biomedical Engineering: Compulsory emester): Specialisation Computer Science: Compuls 7 semester): Specialisation Mechanical Engineering emester): Specialisation Mechanical Engineering. Con emester): Specialisation Mechanical Engineering, Foc Bioprocess Engineering: Elective Compulsory ecialisation Computer Science: Compulsory ecialisation Computer Science: Compulsory ecialisation Biomedical Engineering; Compulsory ecialisation Mechanical Engineering, Focus Biomecha ecialisation Mechanical Engineering, Focus Materials emester): Specialisation Computer Science: Compulsory ecialisation Mechanical Engineering, Focus Materials emester): Specialisation Computer Science: Compulsory erialisation Mechanical Engineering, Focus Materials emester): Specialisation Mechanical Engineering emester): Specialisation Biomedical Engineering: Com	s in Engineering Scienc sory g, Focus Materials in mpulsory cus Biomechanics: Con anics: Compulsory s in Engineering Scienc ory g, Focus Materials in mpulsory	Engineering Scienc npulsory es: Compulsory Engineering Scienc
Examination duration and scale Assignment for the Following	90 minutes General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program): Sp General Engineering Science (German program, 7 sc General Engineering: Specialisation A - General E Computer Science: Specialisation Computational Ma Electrical Engineering: Core qualification: Elective Co General Engineering Science (English program): Spe General Engineering Science (English program, 7 se General Engineer	ecialisation Mechanical Engineering, Focus Biomech becialisation Mechanical Engineering, Focus Materials becialisation Biomedical Engineering: Compulsory emester): Specialisation Computer Science: Compuls 7 semester): Specialisation Mechanical Engineering emester): Specialisation Mechanical Engineering. Con emester): Specialisation Mechanical Engineering, Foc Bioprocess Engineering: Elective Compulsory ecialisation Computer Science: Compulsory ecialisation Computer Science: Compulsory ecialisation Biomedical Engineering, Focus Materials ecialisation Mechanical Engineering, Focus Materials emester): Specialisation Computer Science: Compulsory ecialisation Mechanical Engineering, Focus Materials emester): Specialisation Computer Science: Compulsory ecialisation Mechanical Engineering, Focus Materials emester): Specialisation Biomedical Engineering: emester): Specialisation Biomedical Engineering. For emester): Specialisation Biomedical Engineering. Focus	s in Engineering Scienc sory g, Focus Materials in mpulsory cus Biomechanics: Con anics: Compulsory s in Engineering Scienc ory g, Focus Materials in mpulsory	Engineering Scienc npulsory es: Compulsory Engineering Scienc



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	



Iodule M0684: Heat Trans	for			
Iodule M0664: Heat Trans	ner			
ourses				
tle		Тур	Hrs/wk	CP
eat Transfer (L0458)		Lecture	3	5
eat Transfer (L0459)		Recitation Section (large)	2	1
Module Responsible	Dr. Andreas Moschallski			
Admission Requirements	none			
Recommended Previous	Technical Thermodynamics I, II and Fluid Dynamics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learn	ing 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 approa	ach.		
Autonomy	The students are able to develop a complex problem self-consistent and	d analyse the results in a critical wa	av A qualified exchan	ae with other students
hatonomy	given.			go marcalor cladoria
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following				
Curricula			ystems: Compulsory	
	General Engineering Science (German program): Specialisation Biome			
	General Engineering Science (German program): Specialisation Mecha			
	General Engineering Science (German program, 7 semester): Specialis			
	General Engineering Science (German program, 7 semester): Specia	alisation Mechanical Engineering,	Focus ineoretical N	lechanical Engineeri
	Compulsory	ation Diamodical Engineering. Con		
	General Engineering Science (German program, 7 semester): Specialis		npulsory	
	General Engineering Science (English program): Specialisation Biomeo General Engineering Science (English program): Specialisation Mechan		nice: Compulson	
	General Engineering Science (English program): Specialisation Mechan			
	General Engineering Science (English program): Specialisation Mechan General Engineering Science (English program): Specialisation Mechan			ering: Compulsory
	General Engineering Science (English program). Specialisation Mechan General Engineering Science (English program, 7 semester): Specialisa			
	General Engineering Science (English program, 7 semester): Specials			
	Compulsory	and a moon and a regine entry,	. cous metrelical h	Engineen
	· · · · · · · · · · · · · · · · · · ·			
	General Engineering Science (English program, 7 semester): Specialisa	ation Biomedical Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester): Specialisa Mechanical Engineering: Specialisation Energy Systems: Compulsory	ation Biomedical Engineering: Com	ipulsory	

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



Module M0956: Measureme	nt Technology for Mechanical and Proce	ss Engineers		
Courses				
litle		Тур	Hrs/wk	CP
Practical Course: Measurement and Contr	ol Systems (L1119)	Laboratory Course	2	2
Measurement Technology for Mechanical		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 eng	jineering		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	Students are able to name the most important fundment	als of the Measurement Technology (Quantities	and Units, Uncertaint	y, Calibration, Static a
0	Dynamic Properties of Sensors and Systems).	0, (
	They can outline the most important measuring methods	for different kinds of quantities to be maesured (Electrical Quantities,	Temperature, mechani
	quantities, Flow, Time, Frequency).			
	They can describe important methods of chemical Analys	sis (Gas Sensors, Spectroscopy, Gas Chromatogr	aphy)	
			,	
Skills	Students can select suitable measuring methods to giver	problems and can use refering measurement de	evices in practice.	
			,	
	The students are able to orally explain issues in the sub	ject area of measurement technology and solution	on approaches as we	II as place the issues i
	the right context and application area.			
Personal Competence				
Social Competence	Students can arrive at work results in groups and docum	ent them in a common report		
Autonomy	Students are able to familiarize themselves with new me	asurament technologies		
Autonomy		asurement 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): Specia	alisation Energy and Enviromental Engineering: C	Compulsory	
Curricula	General Engineering Science (German program): Specia			
	General Engineering Science (German program): Specia	alisation Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specia	alisation Process Engineering: Compulsory		
	General Engineering Science (German program, 7 seme	ster): Specialisation Energy and Enviromental Er	ngineering: Compulso	ry
	General Engineering Science (German program, 7 seme			
	General Engineering Science (German program, 7 seme	ster): Specialisation Biomedical Engineering: Co	mpulsory	
	General Engineering Science (German program, 7 seme	ster): Specialisation Process Engineering: Comp	ulsory	
	Energy and Environmental Engineering: Core qualification			
	General Engineering Science (English program): Specia		ompulsory	
	General Engineering Science (English program): Specia			
	General Engineering Science (English program): Specia			
	General Engineering Science (English program): Specia			
	General Engineering Science (English program, 7 seme	, , ,		У
	General Engineering Science (English program, 7 seme	, ,		
	General Engineering Science (English program, 7 seme	, ,		
	General Engineering Science (English program, 7 seme		ulsory	
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Process Engineering: Core qualification: Compulsory			



Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Wolfgang Schröder
Language	DE
Cycle	WiSe/SoSe
Content	Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutant
	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., Wissenschaft
	Verlagsgesellschaft, Stuttgart, 1974
	 Birkle, M.: Meßtechnik f ür den Immissionsschutz, Messen der gas- und partikelf örmigen Luftverunreinigungen. R. Oldenburg Verlag, M ünc 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:
	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
	 Diger, AG.: Optische Nachheimenheim, Tein T. Optische Weiterheimen. Huming Verlag, Heidelberg, 1964 Dakin, J., Cushaw, B.: Optiscal Fibre Sensors: Principles and Components. Artech House Boston, 1988
	 Dakin, J., Ostraw, J.: Optical Tible Sensors: Frinciples and components. Artech House Boston, 1989 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



Тур	ology for Mechanical and Process Engineers Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Sven Krause
Language	DE
Cycle	WiSe 1 Fundamentals
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



Module M1279: MED II: Intr	oduction to Biochemistry and Molecu	ılar Biology		
Courses				
litle		Тур	Hrs/wk	CP
ntroduction 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 reach	ed the following learning results		
Professional Competence				
Knowledge				
	The students can			
	 describe basic biomolecules; 			
	 explain how genetic information is coded i 	n the DNA.		
	 explain the connection between DNA and 			
Skills				
	The students can			
	 recognize the importance of molecular par 	ameters for the course of a disease:		
	describe different molecular-diagnostic tre			
	describe the importance of those treatments for so	me diseases;		
Personal Competence				
Social Competence				
	The students can conduct discussions in research	and medicine on a technical level.		
Autonomy	The students can develop understanding of topics	from the course, using technical literature, by thems	selves	
Workload in Hours	Independent Study Time 62, Study Time in Lecture	28		
Credit points	3			
Examination	Written exam			
Examination duration and scale	60 minutes			
		Specialization Mechanical Engineering Facus Pier	nochanice: Compulson	
Assignment for the Following Curricula		Specialisation Mechanical Engineering, Focus Bion Specialisation Biomedical Engineering: Compulsory		
Guineula		7 semester): Specialisation Biomedical Engineering:		
		7 semester): Specialisation Mechanical Engineering.		mpulsorv
	Electrical Engineering: Specialisation Medical Ted	, , , , , , , , , , , , , , , , , , , ,	.,	
		Specialisation Mechanical Engineering, Focus Biom	echanics: Compulsorv	
		Specialisation Biomedical Engineering: Compulsory		
		semester): Specialisation Mechanical Engineering,		npulsory
		semester): Specialisation Biomedical Engineering:		
	Mechanical Engineering: Specialisation Biomecha	anics: Compulsory		
	Biomedical Engineering: Specialisation Managem	ent and Business Administration: Elective Compulse	ory	
	Biomedical Engineering: Specialisation Artificial C	Organs and Regenerative Medicine: Elective Comput	lsory	
	Biomedical Engineering: Specialisation Medical T	echnology and Control Theory: Elective Compulsory	ý	
	Biomedical Engineering: Specialisation Implants a	and Endoprostheses: Elective Compulsory		
	Technomathematics: Core qualification: Elective C			
	Technomathematics: Specialisation III. Engineering	g Science: Elective Compulsory		

Course L0386: Introduction to Biochemistry and Molecular Biology	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Hans-Jürgen Kreienkamp
Language	DE
Cycle	WiSe
Content	
Literature	Müller-Esterl, Biochemie, Spektrum Verlag, 2010; 2. Auflage
	Löffler, Basiswissen Biochemie, 7. Auflage, Springer, 2008



ourses	
041353	
itle	Typ Hrs/wk CP
troduction to Management (L0880)	Lecture 3 3 Problem-based Learning 2 3
roject Entrepreneurship (L0882) Module Responsible	
Admission Requirements	
Recommended Previous	
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	e After taking this module, students know the important basics of many different areas in Business and Management, from Planning and Organisatio Marketing and Innovation, and also to Investment and Controlling. In particular they are able to
	• explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions from field of Management
	• explain the most important aspects of and goals in Management and name the most important aspects of entreprneurial projects
	• describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and 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 exp
	 some basic methods from mathematical Finance state basics from accounting and costing and selected controlling methods.
Skills	s Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry out Entrepreneurship project in a team. In particular, they are able to
	analyse Management goals and structure them appropriately
	analyse organisational and staff structures of companies
	apply methods for decision making under multiple objectives, under uncertainty and under risk
	analyse production and procurement systems and Business information systems
	analyse and apply basic methods of marketing
	select and apply basic methods from mathematical finance to predefined problems
	apply basic methods from accounting, costing and controlling to predefined problems
Personal Competence	9
Social Competence	e Students are able to
	work successfully in a team of students
	 to apply their knowledge from the lecture to an entrepreneurship project and write a coherent report on the project
	 to communicate appropriately and
	to cooperate respectfully with their fellow students.
Autonomy	y Students are able to
	work in a team and to organize the team themselves
	to write a report on their project.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	
Examination	
Examination duration and scale	90 Minuten
Assignment for the Following	General Engineering Science (German program): Specialisation Electrical Engineering: Compulsory
Curricula	a 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 Enviromental 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): Specialisation Naval Architecture: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Revails 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 Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation 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 Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus 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 Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus 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 Aircraft Systems Engineering: Compuls 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 Computer Science: Compulsory General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus 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



Compulsory
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Civil- and Environmental Engineering: Core qualification: Compulsory
Bioprocess Engineering: Core qualification: Compulsory
Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory
Energy and Environmental Engineering: Core qualification: Compulsory
General Engineering Science (English program): Specialisation Civil- and Enviromental Engeneering: Compulsory
General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory
General Engineering Science (English program): Specialisation Computer Science: Compulsory
General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
General Engineering Science (English program): Specialisation Naval Architecture: Compulsory
General Engineering Science (English program): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Computational Science and Engineering: Core qualification: Compulsory
Logistics and Mobility: Core gualification: 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. Wolfg
	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 Managem
	Marketing and Sales
	Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management
	Definitions as information, information systems, aspects of data security and strategic information systems
	Definition and Relevance of innovations, e.g. innovation opporunities, risks etc.
	Relevance of marketing, B2B vs. B2C-Marketing
	different techniques from the field of marketing (e.g. scenario technique), pricing strategies
	important organizational structures
	basics of human ressource management
	 Introduction to Business Planning and the steps of a planning process
	 Decision Analysis: Elements of decision problems and methods for solving decision problems
	 Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing
	······································
	Relevance of Controlling and selected Controlling methods
	Important aspects of Entrepreneurship projects
Literature	Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008
	Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003
	Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.
	Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.
	Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.
	Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.
	Weber, J., Schäffer, U. : Einführung in das Controlling, 12. Auflage, Stuttgart 2008.
	Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

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



Module M1280: MED II: Intr	Dauction to Physiology			
Courses				
Title		Тур	Hrs/wk	CP
Introduction to Physiology (L0385)		Lecture	2	3
Module Responsible	Dr. Roger Zimmermann			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following lear	rning results		
Professional Competence				
Knowledge				
	The students can			
	 describe the basics of the energy metabolism; 			
	 describe physiological connections in select fields of muscle, h 	eart/circulation, neuro- and s	ensory physiology.	
01.71				
Skills	The shudesta con			
	The students can			
	 describe the effects of basic bodily functions (sensory, transmis 	ssion and processing of inforr	mation, development of forces	and vital functions) a
	relate them to similar technical systems.			
Deve and Commentance				
Personal Competence				
Social Competence	The students can conduct discussions in research and medicine on a t	toophical lovel		
		lecifical level.		
	The students can find solutions to problems in the field of physiology, b	ooth analytical and metrologic	cal	
Autonomy	The students can develop understanding of topics from the course, usi	ing tooppical literature, by the	maalvaa	
Autonomy	The students can develop understanding of topics from the course, usi	ing technical interature, by the	inselves	
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 Mech	nanical Engineering, Focus Bi	iomechanics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation Biom	edical Engineering: Compuls	sory	
	General Engineering Science (German program, 7 semester): Special	isation Biomedical Engineeri	ng: Compulsory	
	General Engineering Science (German program, 7 semester): Special	isation Mechanical Engineeri	ing, Focus Biomechanics: Cor	npulsory
	Electrical Engineering: Specialisation Medical Technology: Elective Co	ompulsory		
	General Engineering Science (English program): Specialisation Mech	anical Engineering, Focus Bi	omechanics: Compulsory	
	General Engineering Science (English program): Specialisation Biome	edical Engineering: Compuls	ory	
	General Engineering Science (English program, 7 semester): Speciali			npulsory
	General Engineering Science (English program, 7 semester): Speciali	sation Biomedical Engineerir	ng: Compulsory	
	Mechanical Engineering: Specialisation Biomechanics: Compulsory			
	Biomedical Engineering: Specialisation Medical Technology and Cont	, , , , , , , , , , , , , , , , , , , ,	,	
	Biomedical Engineering: Specialisation Management and Business A			
	Biomedical Engineering: Specialisation Artificial Organs and Regener		pulsory	
	Biomedical Engineering: Specialisation Implants and Endoprostheses	: Elective Compulsory		
	Technomathematics: Core qualification: Elective Compulsory	0		
	Technomathematics: Specialisation III. Engineering Science: Elective	Compulsory		

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

2



Specialization Naval Architecture

Module M0933: Fundamen	tals of Materials Science			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Materials Science I (L10	*	Lecture	2	2
	vanced Ceramic Materials, Polymers and Composites) (L0506)	Lecture	2	2
Physical and Chemical Basics of Materials		Lecture	2	2
Module Responsible				
Admission Requirements				
Recommended Previous Knowledge	Highschool-level physics, chemistry und mathematics			
Kilowiedge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The students have acquired a fundamental knowledge on me	etals, ceramics and polymers an	d can describe this know	ledge comprehensively
-	Fundamental knowledge here means specifically the issues of at			
	mechanical properties. The students know about the key aspec	ts of characterization methods for	materials and can identify	relevant approaches fo
	characterizing specific properties. They are able to trace materials	phenomena back to the underlying	physical and chemical law	rs of nature.
Skills	The students are able to trace materials phenomena back to the			
	mechanical properties such as strength, ductility, and stiffness, ch			
	solidification, precipitation, or melting. The students can explain t		onditions and the materials	microstructure, and the
	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 E	Energy and Enviromental Engineeri	ng: Compulsory	
Curricula	General Engineering Science (German program): Specialisation N	Mechanical Engineering: Compulso	ry	
	General Engineering Science (German program): Specialisation E	Biomedical Engineering: Compulso	ry	
	General Engineering Science (German program): Specialisation N	Vaval Architecture: Compulsory		
	General Engineering Science (German program, 7 semester): Spe	ecialisation Mechanical Engineering	g: 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		al Engineering: Compulsor	y
	Energy and Environmental Engineering: Core qualification: Comp			
	General Engineering Science (English program): Specialisation E	••		
	General Engineering Science (English program): Specialisation M	• • •	-	
	General Engineering Science (English program): Specialisation B		у	
	General Engineering Science (English program): Specialisation N		0	
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe			
	General Engineering Science (English program, 7 semester): Spe		ai Engineering: Compulsory	1
	Logistics and Mobility: Specialisation Engineering Science: Electiv	ve Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Nevel Architecture: One qualifie the O			
	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 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	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				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880)		Lecture	3 2	3 3
roject Entrepreneurship (L0882)	Draf Christoph Ibl	Problem-based Learning	2	3
Module Responsible	,			
Admission Requirements Recommended Previous				
Knowledge	-			
Educational Objectives		ing results		
Professional Competence		ing readita		
Knowledge			nagement, from Planr	ning and Organisation
Skills	 explain the differences between Economics and Management ar field of Management explain the most important aspects of and goals in Management describe and explain basic business functions as production, pressource management, information management, innovation masses are basic methods from mathematical Finance state basics from accounting and costing and selected controlling Students are able to analyse business units with respect to diffe 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, un analyse and apply basic methods of marketing select and apply basic methods from mathematical finance to pre apply basic methods from accounting, costing and controlling to present the second structure finance to pre 	and name the most important aspe- procurement and sourcing, supply of anagement and marketing iness, esp. in situations under mul g methods. erent criteria (organization, object der uncertainty and under risk rmation systems edefined problems	cts of entreprneurial p chain management, c Itiple objectives and	projects organization and hum uncertainty, and expl
Social Competence	 work successfully in a team of students to apply their knowledge from the lecture to an entrepreneurship to communicate appropriately and to cooperate respectfully with their fellow students. 	project and write a coherent report	on the project	
	 to write a report on their project. 			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
	Written exam			
Examination				
	90 Minuten			
Examination		cal Engineering: Compulsory		
Examination Examination duration and scale	General Engineering Science (German program): Specialisation Electric			
Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric	iter Science: Compulsory		
Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric General Engineering Science (German program): Specialisation Compu General Engineering Science (German program): Specialisation Proces General Engineering Science (German program): Specialisation Biopro	uter Science: Compulsory is Engineering: Compulsory cess Engineering: Compulsory		
Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric General Engineering Science (German program): Specialisation Compu General Engineering Science (German program): Specialisation Proces General Engineering Science (German program): Specialisation Biopro General Engineering Science (German program): Specialisation Energy	uter Science: Compulsory is Engineering: Compulsory cess Engineering: Compulsory v and Enviromental Engineering: Co		
Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric General Engineering Science (German program): Specialisation Compu General Engineering Science (German program): Specialisation Proces General Engineering Science (German program): Specialisation Biopro General Engineering Science (German program): Specialisation Energy General Engineering Science (German program): Specialisation Civil- a	uter Science: Compulsory is Engineering: Compulsory cess Engineering: Compulsory v and Enviromental Engineering: Co ind Enviromental Engeneering: Cor		
Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric General Engineering Science (German program): Specialisation Compu General Engineering Science (German program): Specialisation Proces General Engineering Science (German program): Specialisation Biopro General Engineering Science (German program): Specialisation Energy General Engineering Science (German program): Specialisation Civil- a General Engineering Science (German program): Specialisation Civil- a General Engineering Science (German program): Specialisation Mecha	uter Science: Compulsory is Engineering: Compulsory cess Engineering: Compulsory v and Enviromental Engineering: Co ind Enviromental Engeneering: Cor nical Engineering: Compulsory		
Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric General Engineering Science (German program): Specialisation Compu General Engineering Science (German program): Specialisation Proces General Engineering Science (German program): Specialisation Biopro General Engineering Science (German program): Specialisation Energy General Engineering Science (German program): Specialisation Civil- a General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha	Iter Science: Compulsory is Engineering: Compulsory cess Engineering: Compulsory and Enviromental Engineering: Co ind Enviromental Engeneering: Cor nical Engineering: Compulsory dical Engineering: Compulsory		
Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric General Engineering Science (German program): Specialisation Compu General Engineering Science (German program): Specialisation Proces General Engineering Science (German program): Specialisation Biopro General Engineering Science (German program): Specialisation Energy General Engineering Science (German program): Specialisation Civil- a General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Biopro General Engineering Science (German program): Specialisation Mecha	ater Science: Compulsory is Engineering: Compulsory cess Engineering: Compulsory and Enviromental Engineering: Co and Enviromental Engeneering: Cor nical Engineering: Compulsory dical Engineering: Compulsory Architecture: Compulsory	npulsory	
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Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric General Engineering Science (German program): Specialisation Compu General Engineering Science (German program): Specialisation Proces General Engineering Science (German program): Specialisation Bioprov General Engineering Science (German program): Specialisation Energy General Engineering Science (German program): Specialisation Civil- a General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Bioprov General Engineering Science (German program): Specialisation Naval General Engineering Science (German program): Specialisation Naval General Engineering Science (German program, 7 semester): Specialis General Engineering Science (German program, 7 semester): Specialis	Iter Science: Compulsory is Engineering: Compulsory or and Enviromental Engineering: Co nd Enviromental Engineering: Co nical Engineering: Compulsory dical Engineering: Compulsory Architecture: Compulsory ation Electrical Engineering: Compul ation Process Engineering: Compul	ulsory Isory	
Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric General Engineering Science (German program): Specialisation Compu General Engineering Science (German program): Specialisation Proces General Engineering Science (German program): Specialisation Bioprov General Engineering Science (German program): Specialisation Energy General Engineering Science (German program): Specialisation Civil- a General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Naval General Engineering Science (German program, Specialisation Naval General Engineering Science (German program, 7 semester): Specialis General Engineering Science (German program, 7 semester): Specialis General Engineering Science (German program, 7 semester): Specialis	Iter Science: Compulsory is Engineering: Compulsory or and Enviromental Engineering: Cor nd Enviromental Engineering: Cor nical Engineering: Compulsory dical Engineering: Compulsory Architecture: Compulsory ation Electrical Engineering: Compu- ation Process Engineering: Compu- ation Biomedical Engineering: Compu-	ulsory Isory Ipulsory	
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Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric General Engineering Science (German program): Specialisation Compu- General Engineering Science (German program): Specialisation Proces General Engineering Science (German program): Specialisation Energy General Engineering Science (German program): Specialisation Energy General Engineering Science (German program): Specialisation Civil- a General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Naval General Engineering Science (German program, 7 semester): Specialis General Engineering Science (German program, 7 semester): Specialis	Iter Science: Compulsory is Engineering: Compulsory cess Engineering: Compulsory r and Enviromental Engineering: Cor nical Engineering: Compulsory dical Engineering: Compulsory dical Engineering: Compulsory Architecture: Compulsory ation Electrical Engineering: Compu- ation Process Engineering: Compu- ation Naval Architecture: Compulsor ation Computer Science: Compulsor ation Bioprocess Engineering: Com- ation Civil Engineering: Compulsor	ulsory Isory Ipulsory Iry Ipulsory Ipulsory Ipulsory y	v
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Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric General Engineering Science (German program): Specialisation Compu- General Engineering Science (German program): Specialisation Process General Engineering Science (German program): Specialisation Energy General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Naval / General Engineering Science (German program): Specialisation Naval / General Engineering Science (German program, 7 semester): Specialis General Engineering Science (German program, 7 semester): Specialis	Iter Science: Compulsory as Engineering: Compulsory cess Engineering: Compulsory r and Enviromental Engineering: Cor- nical Engineering: Compulsory dical Engineering: Compulsory dical Engineering: Compulsory Architecture: Compulsory ation Electrical Engineering: Compu- ation Process Engineering: Compul- ation Naval Architecture: Compulsor ation Bioprocess Engineering: Com- ation Giprocess Engineering: Com- ation Giprocess Engineering: Com- ation Computer Science: Compulsor ation Mechanical Engineering, Foct ation Mechanical Engineering, Foct ation Mechanical Engineering, Foct	ulsory Isory Ipulsory Iry Ipulsory Inteering: Compulsory Is Mechatronics: Con Us Biomechanics: Con Us Aircraft Systems Er	, npulsory mpulsory ngineering: Compulso
Examination Examination duration and scale Assignment for the Following	General Engineering Science (German program): Specialisation Electric General Engineering Science (German program): Specialisation Compu- General Engineering Science (German program): Specialisation Process General Engineering Science (German program): Specialisation Energy General Engineering Science (German program): Specialisation Mecha General Engineering Science (German program): Specialisation Naval / General Engineering Science (German program): Specialisation Naval / General Engineering Science (German program, 7 semester): Specialis General Engineering Science (German program, 7 semester): Specialis	Iter Science: Compulsory as Engineering: Compulsory cess Engineering: Compulsory r and Enviromental Engineering: Com- nical Engineering: Compulsory dical Engineering: Compulsory dical Engineering: Compulsory Architecture: Compulsory ation Electrical Engineering: Compu- ation Process Engineering: Compul- ation Naval Architecture: Compulsor ation Bioprocess Engineering: Com- ation Givil Engineering: Compul- ation Computer Science: Compulsor ation Computer Science: Compulsor ation Dioprocess Engineering: Com- ation Civil Engineering: Com- ation Mechanical Engineering, Foca- ation Mechanical Engineering, Foca- Barta M	ulsory Isory Isory Ipulsory Iry Ipulsory y Jineering: Compulsory y us Mechatronics: Con us Biomechanics: Con us Aircraft Systems Er , Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Scienc



Cor	npulsory
Ger	neral Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Cor	npulsory
Ger	neral Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Civi	il- and Environmental Engineering: Core qualification: Compulsory
Biop	process Engineering: Core qualification: Compulsory
Cor	nputer Science: Core qualification: Compulsory
Elec	ctrical Engineering: Core qualification: Compulsory
Ene	rgy and Environmental Engineering: Core qualification: Compulsory
Ger	neral Engineering Science (English program): Specialisation Civil- and Enviromental Engeneering: Compulsory
Ger	neral Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
Ger	neral Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
Ger	neral Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory
Ger	neral Engineering Science (English program): Specialisation Computer Science: Compulsory
Ger	neral Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
Ger	neral Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
Ger	neral Engineering Science (English program): Specialisation Naval Architecture: Compulsory
Ger	neral Engineering Science (English program): Specialisation Process Engineering: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Cor	npulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Cor	npulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Cor	npulsory
Ger	neral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Cor	nputational Science and Engineering: Core qualification: Compulsory
Log	istics and Mobility: Core qualification: Compulsory
Med	chanical Engineering: Core qualification: Compulsory
Med	chatronics: Core qualification: Compulsory
Nav	val Architecture: Core qualification: Compulsory
Tec	hnomathematics: Core qualification: Compulsory
Pro	cess Engineering: Core qualification: Compulsory



Irse 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. Wolfgar
	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods
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 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 Manual B. Sc. "General Engineering Science (English program)"



Module M0854: Mathematics IV					
Courses					
Title		Тур	Hrs/wk	CP	
Differential Equations 2 (Partial Differentia		Lecture	2	1	
Differential Equations 2 (Partial Differentia	Equations) (L1044)	Recitation Section (small)	1	1	
Differential Equations 2 (Partial Differential Equations) (L1045)		Recitation Section (large)	1	1	
Complex Functions (L1038)		Lecture	2	1	
Complex Functions (L1041)		Recitation Section (small)	1	1	
Complex Functions (L1042)		Recitation Section (large)	1	1	
Module Responsible	Prof. Anusch Taraz				
Admission Requirements	none				
Recommended Previous	Mathematics 1 - III				
Knowledge					
Educational Objectives	After taking part successfully, students have reached the	he following learning results			
Professional Competence		·			
	Knowledge				
Nitowicage	Students can name the basic concepts in Math	ematics IV. They are able to explain them using appr	ropriate examples.		
	Students can discuss logical connections betw	een these concepts. They are capable of illustrating	these connections w	th the help of example	
	They know proof strategies and can reproduce	them.			
<u> </u>					
Skills	Students can model problems in Mathematics	IV with the help of the concepts studied in this cours	se. Moreover. they are	capable of solving th	
	by applying established methods.		, anoy un		
		logical connections between the concepts studied ir	n the equiree		
		-			
	For a given problem, the students can develop	and execute a suitable approach, and are able to cri	itically evaluate the re	sults.	
Personal Competence					
Social Competence					
	Students are able to work together in teams. They are capable to use mathematics as a common language.				
	 In doing so, they can communicate new concepts according to the needs of their cooperating partners. Moreover, they can design examples to 				
	check and deepen the understanding of their p	eers.			
	, , ,				
Autonomy	 Students are capable of checking their unders 	standing of complex concepts on their own. They ca	an specify open ques	ions precisely and kn	
	 Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in celving them. 				
	where to get help in solving them.				
	Students have developed sufficient persistence to be able to work for longer periods in a goal-oriented manner on hard problems.				
Workload in Hours	Independent Study Time 68, Study Time in Lecture 11:	2			
Credit points					
Examination	Written exam				
Examination duration and scale	60 min (Complex Functions) + 60 min (Differential Equ	ations 2)			
Assignment for the Following	General Engineering Science (German program): Spe	cialisation Electrical Engineering: Compulsory			
Curricula	General Engineering Science (German program): Spe		onics: Compulsorv		
	General Engineering Science (German program): Spe	6 0,		eering: Compulsory	
		• •	a. moonamoai Englii	soung. Compulsory	
	General Engineering Science (German program): Spe				
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory				
	General Engineering Science (German program, 7 ser				
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering				
	Compulsory				
	General Engineering Science (German program, 7 ser	mester): Specialisation Naval Architecture: Compuls	ory		
	Computer Science: Specialisation Computational Mat				
	Electrical Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Naval Architecture: Compulsory				
	General Engineering Science (English program): Spec	cialisation Mechanical Engineering, Focus Mechatro	nics: Compulsory		
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory				
			us Mechatronics: Cor		
	General Engineering Science (English program, 7 sen	nester): Specialisation Mechanical Engineering Foo		npulsory	
	General Engineering Science (English program, 7 sen General Engineering Science (English program, 7 sen	, ,			
	General Engineering Science (English program, 7 sen General Engineering Science (English program, 7 sen General Engineering Science (English program, 7	, ,			
	General Engineering Science (English program, 7 sen General Engineering Science (English program, 7 sen General Engineering Science (English program, 7 s Compulsory	semester): Specialisation Mechanical Engineering,	, Focus Theoretical I		
	General Engineering Science (English program, 7 sen General Engineering Science (English program, 7 sen General Engineering Science (English program, 7	semester): Specialisation Mechanical Engineering,	, Focus Theoretical I		
	General Engineering Science (English program, 7 sen General Engineering Science (English program, 7 sen General Engineering Science (English program, 7 s Compulsory	semester): Specialisation Mechanical Engineering, nester): Specialisation Naval Architecture: Compulso	, Focus Theoretical I		
	General Engineering Science (English program, 7 sen General Engineering Science (English program, 7 sen General Engineering Science (English program, 7 Compulsory General Engineering Science (English program, 7 sen	semester): Specialisation Mechanical Engineering, nester): Specialisation Naval Architecture: Compulso on Engineering Sciences: Elective Compulsory	, Focus Theoretical I		
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	General Engineering Science (English program, 7 sen General Engineering Science (English program, 7 sen General Engineering Science (English program, 7 sen Compulsory General Engineering Science (English program, 7 sen Computational Science and Engineering: Specialisatio Computational Science and Engineering: Specialisatio Mechanical Engineering: Specialisation Theoretical M Mechanical Engineering: Specialisation Mechatronics	semester): Specialisation Mechanical Engineering, nester): Specialisation Naval Architecture: Compulso on Engineering Sciences: Elective Compulsory on Computer Science: Elective Compulsory lechanical Engineering: Compulsory : Compulsory	, Focus Theoretical I		



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

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

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

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



Course L1041: Complex Functions	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course
Course L1042: Complex Functions	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14

Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0960: Mechanics	IV (Kinetics II, Oscillations, Analytical Mecha	nics, Multibody Systems)		
Courses				
litle		Тур	Hrs/wk	CP
Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) (L1137)		Lecture	3	3
Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) (L1138)		Recitation Section (small)	2	2
lechanics IV (Kinetics II, Oscillations, An	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 foll	owing learning results		
Professional Competence				
Knowledge	The students can			
	describe the axiomatic procedure used in mechanica	Il contexts;		
	 explain important steps in model design; 			
	 present technical knowledge. 			
Skills	The students can			
	explain the important elements of mathematical / me	chanical analysis and model formation, and app	ply it to the context of	their own problems;
	 apply basic methods to engineering problems; 			
	 estimate the reach and boundaries of the methods a 	nd 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 o	overcome difficulties.		
Autonomy	Students are capable of determining their own strengths and	weaknesses and to organize their time and le	arning based on thos	se.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisa	ation Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisa	tion Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 semeste	r): Specialisation Mechanical Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semeste	r): Specialisation Biomedical Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semeste	r): Specialisation Naval Architecture: Compulso	iry	
	General Engineering Science (English program): Specialisa	tion Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisa	tion 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: Compulso	ry	
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science			
	Technomathematics: Core qualification: Elective Compulsor			
	Theoretical Mechanical Engineering: Technical Complement	tary Course Core Studies: Elective Compulsor	Ý	

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



Course L1138: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems)		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	
Course L1139: Mechanics IV (Kinet	ics II, Oscillations, Analytical Mechanics, Multibody Systems)	
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Robert Seifried	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0680: Fluid Dyna	mice			
	mics			
Courses				
Title		Тур	Hrs/wk	CP
Fluid Mechanics (L0454)		Lecture	3	4
Fluid Mechanics (L0455)		Recitation Section (large)	2	2
Module Responsible	Prof. Thomas Rung			
Admission Requirements	none			
Recommended Previous	Sound knowledge of engineering mathematics, engineering mechanics and thermodynamics.			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follo	wing learning results		
Professional Competence				
Knowledge	Students will have the required sound knowledge to explain	the general principles of fluid engineering a	nd physics of fluids. S	Students can scientifica
Ũ	outline the rationale of flow physics using mathematical mo			
	engineering devices.		-	·
Skills	Students are able to apply fluid-engineering principles and fl			re enables the studen
	carry out all necessary theoretical calculations for the fluid dy	namic design of engineering devices on a sci	entific level.	
Personal Competence				
Social Competence	The students are able to discuss problems and jointly develo	p solution strategies.		
Autonomy	my The students are able to develop solution strategies for complex problems self-consistent and crtically analyse results.			
hatonomy		iex problems sen consistent and choarry and		
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): 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: Co	mpulsory	
	General Engineering Science (German program, 7 semester)	: Specialisation Biomedical Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester)	: Specialisation Naval Architecture: Compulse	ory	
	General Engineering Science (English program): Specialisat	ion Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisat	ion Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisat	ion Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 semester)	: Specialisation Mechanical Engineering: Cor	npulsory	
	General Engineering Science (English program, 7 semester)	: Specialisation Biomedical Engineering: Con	pulsory	
	General Engineering Science (English program, 7 semester)	: Specialisation Naval Architecture: Compulso	iry	
	Computational Science and Engineering: Specialisation Eng	ineering Sciences: Elective Compulsory		
	Mechanical Engineering: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science:	Flasting Computers		

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



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



Madula M0640, Stachastia	and Chin Dynamica			
Module M0640: Stochastics	and Ship Dynamics			
Courses				
Title		Тур	Hrs/wk	CP
Ship Dynamics (L0352)		Lecture	2	3
Ship Dynamics (L1620)		Recitation Section (small)	1	1
Statistics and Stochastic Processes in Na	val Architecure and Ocean Engineering (L0364)	Lecture	2	3
Module Responsible	Prof. Moustafa Abdel-Maksoud			
Admission Requirements	None			
Recommended Previous	Technical mechanics			
Knowledge	 Linear algebra, analysis, complex numbers 			
	 Fluid mechanics 			
Educational Objectives	After taking part successfully, students have reached the follo	owing learning results		
Professional Competence				
Knowledge	- The students are able to give an overview over various m	nanoeuvres. They can name application goa	ls and they can desc	ribe the procedure of t
	manoeuvres.			
	- The students are able to give an overview over varius rudde	er types. They can name criteria in the rudder	desian.	
			doolgin	
	- The students can name computation methods which are use	ed to determine forces and motions in waves		
Skills	- The students can come up with the equations of motions wh	high are used to discribe managewros. The ea	n use and linearise th	om
Skills	- The students can come up with the equations of motions with	include used to discribe manoeuvies. The ca	n use and intearise th	enn.
	- The students are able to determine hydrodynamic coefficier	nts and they can explain their physical meani	ng.	
	- The students can explain how a rudder works and they can	explain the physical effects which can occur.		
	- The students can mathematically describe waves.			
	- The students can explain the mathematically description of	harmoncial motions in waves and they can d	etermine them.	
Personal Competence	_			
Social Competence	- The students can arrive at work results in groups and docun	nent them.		
	- The students can discuss in groups and explain their point of	of view.		
Autonomy	- The students can assess their own strengthes and weaknes	sses and the define further work steps on this	basis.	
Workload in Hours	Independent Study Time 140, Study Time in Lecture 70			
Credit points	7			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Naval Architecture: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compute	sory	
	General Engineering Science (English program): Specialisat	tion Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 semester)	: Specialisation Naval Architecture: Compuls	ory	
	Naval Architecture: Core qualification: Compulsory			



Course L0352: Ship Dynamics	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Moustafa Abdel-Maksoud
Language	DE
Cycle	SoSe
Content	Maneuverability of ships
	Equations of motion
	Equations of motion Hydrodynamic forces and moments
	Linear equations and their solutions
	Full-scale trials for evaluating the maneuvering performance
	Regulations for maneuverability
	Rudder
	O selection
	Seakeeping
	Representation of harmonic processes
	Motions of a rigid ship in regular waves
	Flow forces on ship cross sections
	Strip method
	Consequences induced by ship motion in regular waves
	Behavior of ships in a stationary sea state
	Long-term distribution of seaway influences
1 the sectors	
Literature	Abdel-Maksoud, M., Schiffsdynamik, Vorlesungsskript, Institut für Fluiddynamik und Schiffstheorie, Technische Universität Hamburg-Harburg,
	2014
	Abdel-Maksoud, M., Ship Dynamics, Lecture notes, Institute for Fluid Dynamic and Ship Theory, Hamburg University of Technology, 2014
	 Bertram, V., Practical Ship Design Hydrodynamics, Butterworth-Heinemann, Linacre House - Jordan Hill, Oxford, United Kingdom, 2000
	 Beattacharyya, 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
	1

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



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, Technisc Universität Hamburg-Harburg, 2014 W. Blendermann "Grundlagen der Wahrscheinlichkeitsrechnung", Vorlesungsskript, Arbeitsbereich Fluiddynamik und Schiffstheorie, Technisc Universität Hamburg-Harburg, 2001 H. W. Coleman, W. G. Steele, Experimentation and Uncertainty Analysis for Engineers, 3rd Edition, John Wiley & Sons, Inc., New York, NY, 2009 ITTC Recommended Procedures and Guidelines, In: Quality Systems Manual, International Towing Tank Conference (ITTC), 2011 F.M. Dekking, C. Kraaikamp, H.P. Lopuhaä, L.E. Meester, A Modern Introduction To Probability and Statistics, Springer, 2005 Springer Handbook of Engineering Statistics, H. Pham (Hrsg.), Springer, 2006 A. Klenke, Wahrscheinlichkeitstheorie, Springer, 2013



Module M0655: Computation	onal Fluid Dynamics I			
Courses				
Title		Тур	Hrs/wk	CP
Computational Fluid Dynamics I (L0235)		Lecture	2	3
Computational Fluid Dynamics I (L0419)		Recitation Section (large)	2	3
Module Responsible	Prof. Thomas Rung			
Admission Requirements	None			
Recommended Previous	 Mathematical Methods for Engineers 			
Knowledge	 Fundamentals of Differential/integral calculus and series 	expansions		
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	The students are able to list the basic numerics of partial differen	tial equations.		
Skills	The students are able develop appropriate numerical integra	tion in space and time for the governing	partial differential ed	quations. They can code
	computational algorithms in a structured way.			
Barconal Competence				
Personal Competence	<u></u>			
Social Competence	The students can arrive at work results in groups and document	them.		
Autonomy	The students can independently analyse approaches to solving	specific problems.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	2h			
Assignment for the Following	General Engineering Science (German program): Specialisation	Mechanical Engineering, Focus Energy	Systems: Compulsory	
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): S		ory	
	General Engineering Science (German program, 7 semester): S			Elective Compulsory
	General Engineering Science (English program): Specialisation	Naval Architecture: Compulsory		
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Energy S	Systems: Compulsory	
	General Engineering Science (English program, 7 semester): Sp	pecialisation Naval Architecture: Compuls	ory	
	General Engineering Science (English program, 7 semester): Sp	pecialisation Mechanical Engineering, Fo	cus Energy Systems: E	Elective Compulsory
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Ele	ective Compulsory		
	Technomathematics: Specialisation III. Engineering Science: Ele	ective Compulsory		

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



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



Module M0659: Fundament	tals of Ship Structural Design and Analysis			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Ship Structural Design (L0411)		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 the foll	owing learning results		
Professional Competence		- •		
Knowledge	Students can reproduce the basic contents of the structural	behaviour of ship structures: they can explain	the theory and meth	nods for the calculation
raiomougo	deformations and stresses in beam-like structures.		and anothy and mot	
	Furthermore, they can reproduce the basis contents of con	des (rules), materials, semi-finished products,	joining and principl	es of structural design
	components in the ship structure.			
Skills	Students are capable of applying the methods and tools for	r the calculation of linear deformations and stre	esses in the above n	nentioned structures: the
	can choose calculation models of typical ship structures.			
	Furthermore, they are capable to apply the methods of draw	wing and sizing the ship structure; they can se	lect suitable materia	ls, semi-finished produc
	and joints.			
Personal Competence				
Social Competence	The students are able to communicate and cooperate in a pr	rofessional environment in the shipbuilding and	d component supply	industry.
Autonomy	The students are capable to independently idealize real s	hip structures and to select suitable methods	for analysis of bear	n-like structures; they a
	capable to assess the results of structural analyses.			
	Furthermore, they are capable to assess drawings of com	inlex ship structures and to design ship struct	tures for various rec	uirements and bounda
	conditions.	were stup of dotation and to design stup stude		
	ounditions.			
Workload in Hours	Independent Study Time 156, Study Time in Lecture 84			
Credit points	8			
Examination	Written exam			
Examination duration and scale	3 hours			
Assignment for the Following	General Engineering Science (German program): Specialisa	ation Naval Architecture: Compulsory		
Curricula	General Engineering Science (German program, 7 semeste		ory	
	General Engineering Science (English program): Specialisa		-	
	General Engineering Science (English program, 7 semester		rv	
	Naval Architecture: Core qualification: Compulsory	, employed a computer	,	
	ravar a contecture. Oure quantication. Compulsory			



Course L0411: Fundamentals of Shi	p Structural Design
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Sören Ehlers
Language	DE
Cycle	WiSe
Content	Chapters:
	1. Introduction
	3. Class societies and their tasks
	4. Materials for steel shipbuilding
	5. Welding and Cutting
	6. Semi-finished products in steel shipbuilding
	7. Determining the scantlings for local loads
	8. Longitudinal strength of the hull girder
	9. Determining the scantlings of longitudinal structural members
	10. Determining the scantlings of bottom and side structures
	11. Decks and Hatch Openings
	12. Effective breadth
	13. Iterative determination of scantlings (POSEIDON)
Literature	Vorlesungsskript mit weiteren Literaturangaben wird über das Internet verfügbar gemacht

Course L0413: Fundamentals of Ship Structural Design		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Sören Ehlers	
Language	DE	
Cycle	WiSe	
Content	Chapters:	
	1. Introduction	
	3. Class societies and their tasks	
	4. Materials for steel shipbuilding	
	5. Welding and Cutting	
	6. Semi-finished products in steel shipbuilding	
	7. Determining the scantlings for local loads	
	8. Longitudinal strength of the hull girder	
	9. Determining the scantlings of longitudinal structural members	
	10. Determining the scantlings of bottom and side structures	
	11. Decks and Hatch Openings	
	12. Effective breadth	
	13. Iterative determination of scantlings (POSEIDON)	
Literature	Vorlesungsskript mit weiteren Literaturangaben wird über das Internet verfügbar gemacht	

Course L0410: Fundamentals of Shi	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 Shi	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 Ship Structural Design (L0412)		Typ Lecture	Hrs/wk 2	СР 3
Ship Structural Design (L0415) Welding Technology (L1123)		Recitation Section (small) Lecture	2 3	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 following	learning results		
Professional Competence				
Knowledge	Students can reproduce design and sizing as well as fabrication they can describe calculation models for complex structures.	of the different areas of ship structures a	and of different ship ty	rpes (incl. detail design)
Skills	Students are capable to specify the requirements for different sl suitable calculation models and to assess the chosen structure	nip types and areas of the hull, to define	e design criteria for th	e components, to selec
Personal Competence Social Competence	Students are capable to present their structural design and discus	s their decisions constructively in a group	o.	
Autonomy	Students are capable to design independently different structura methods.	al areas of the ship hull and different sh	ip types and to define	appropriate fabricatio
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 Curricula	General Engineering Science (German program): Specialisation I General Engineering Science (German program, 7 semester): Sp General Engineering Science (English program): Specialisation N General Engineering Science (English program, 7 semester): Spe	ecialisation Naval Architecture: Compulse laval Architecture: Compulsory		
	Naval Architecture: Core qualification: Compulsory	olanouller reavair rioniteotare. Oompuise	,	



Course L0412: Ship Structural Desig	gn
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. Outfitting 7. Bulk carriers 8. Tankers 9. Container ships 10. Production-kind steel structural design 11. Buckling and ultimate strength
Literature	12. Safety factors and reliability of structures

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
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Claus Emmelmann, Prof. Karl-Ulrich Kainer
Language	DE
Cycle	WiSe
Content	- phase transitions, phase diagrams and thermal activated processes
	- fundamentals of steels, heat treatment applications for steels and time temperature transformation diagrams
	- properties of weldable carbon and fine grained steels
	- properties of weldable low- and high-alloy steels, corrosion resistant steels and high-strength steels
	- structure and properties of non-ferrite metals (aluminum, titanium)
	- NDT/DT Methods for materials and welds
	- gas fusion welding, fundamentals of electric arc welding technologies
	- structure and influence parameters for the welded joint
	- submerged arc welding/tungsten inert gas welding/inert gas metal arc welding (MIG)/active gas metal arc welding (MAG)/Plasma Welding
	- resistance welding/ polymer welding/ hybrid-welding
	- deposition welding
	- electron beam welding/ laser beam welding
	- weld joint designs and declarations
	- computation methods for weld joint dimensioning
Literature	Schulze, G.: Die Metallurgie des Schweißens, 4. Aufl., Berlin 2010 Strassburg, F.W. und Wehner H.: Schweißen nichtrostender Stähle, 4. Aufl.
	Düsseldorf, 2009 Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 1: Schweiß- und Schneidtechnologien, 3. Aufl., Berlin 2006.
	Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 2: Verhalten der Werkstoffe beim Schweißen, 3. Aufl., Berlin 2005.
	Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 3: Gestaltung und Festigkeit von Schweißkonstruktionen, 2. Aufl., Berlin 2002.
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Module M1118: Hydrostatio	cs and Body Plan			
Courses				
Title		Тур	Hrs/wk	CP
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 Mechanic	es I-III.		
Knowledge	It is recommended that the students are familiar with	typical design relevant drawings, e.g. Body Plan, GA	- Plan, Tank Plan etc.	
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	The lecture enables the student to carry out all nece	ssary theoretical calculations for ship design on a sci	entific level. The lectur	e is basic requirement fo
	all following lectures in the subjects shipo design and safety of ships.			
Skills				
	capsizing or sinking.			
Personal Competence				
Social Competence	The student gets access to hydrostatical problems.			
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 8	34		
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): S	pecialisation Naval Architecture: Compulsory		
Curricula	General Engineering Science (German program, 7 s	emester): Specialisation Naval Architecture: Comput	sory	
	General Engineering Science (English program): Sp	ecialisation Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 s	emester): Specialisation Naval Architecture: Compuls	sory	
	Naval Architecture: Core qualification: Compulsory			

Course L1260: Hydrostatics	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Stefan Krüger
Language Cycle	DE SoSe
Content	1. Numerical Integration, Diffrentation, Interpolation
	- Trapezoidal Rule, Simpson, Tschebyscheff, graphical Integration Methods
	- Determination of Areas, 1st and 2nd order Moments
	- Numerical Diffrentation, Spline Interpolation
	2. Buyoancy
	- Principle of Archimedes
	- Equilbrium Floating Condition
	- Equilbrium 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
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D. 00	
	- 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
Horst	1. Hamar/Russhi Dia Thaoria dae Sehifaa
Literature	1. Herner/Rusch: Die Theorie des Schiffes

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

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 Henschke Schiffstechnisches Handbuch, Band 1 VEB Technik Verlag Berlin
 Das Skript zur Vorlesung, Anwendungsbeispiele und Klausuren sind auf unserer Homepage abrufbar.

Course L1261: Hydrostatics		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Prof. Stefan Krüger	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L1452: Body Plan	
Тур	Project Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Krüger
Language	DE
Cycle	WiSe
Content	As preparation for the lecture "Hydrostatics", the students must develop a body plan of a modern twin screw vessel (cruise liner, RoPAx- feryy, RoRo) and perform elementary volumetric computations. The body plan is to be developed from a given GA or can be designed freely. All computations shall be based on graphical integration methods. The body plan consists of : - Grid - approx. 20 sections, 5 Waterlines, 5 Buttocks - Computation Volume and centre of buoyancy for several drafts - Computation of Righting Lever curve for a given displacement based on and graphical integration for several heeling angles.
Literature	1. Herner/Rusch: Die Theorie des Schiffes Fachbuchverlag Leipzig 2. Henschke Schiffstechnisches Handbuch, Band 1 VEB Technik Verlag Berlin 3. Das Skript zur Vorlesung, Anwendungsbeispiele und Klausuren sind auf unserer Homepage abrufbar.



Module 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				
Knowledge	Mechanics			
	Fluid Dynamics for Naval Architects			
	Hydrostratics			
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results		
Professional Competence				
Knowledge	The hydrodynamic basics that are relevant for resistance and	propulsion of ships are discussed. The diff	erent resistance phenc	omena and their practica
	applications to hullform design as well as numerical and emp	irical 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 s	cale ships. This hold	also for propulsion and
	hullefficiency elements, mainly thrust deduction and wake.	Main Focus is how hull forms can be	optimized for minimu	m and sustainable fue
	consumption. The following topics are dealt with:			
	- Stillwater/added resistance, Wave resistance, Minimization of wave resistance, numerical prediction methods, friction laws, laminar/turbulent flow			
	separation, Hull form design for redcude flow separation, Appendage Design and resistance, Froude's resistance law, form factor method, thrust			
	deduction, wake, model scaling laws, resistance tests, free running propeller tests and propeller basics, propulsion tests, full scale speed power			
	predictions, additional resistances (wind, steering, current, sea	state), EEDI, speed trials, contractual matte	ers concerning speed/p	oower, bunker claims
Skills	The student shall learn to design competitive hull forms with respect to fuel consumption by applying numreical techniques and to evaluate these hull		to evaluate these hulls	
	by several progosis methods. Furtermore, the course will			
	environmental influences.			iquired potter including
Personal Competence				
Social Competence	The student learns to prepare technical matters in such a way i	that he can compte with his building suverv	ision team.	
Autonomy	The student learns to prepare technical matters in such a way to	that 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	on Naval Architecture: Compulsory		
Curricula	General Engineering Science (German program, 7 semester):	Specialisation Naval Architecture: Compute	sory	
	General Engineering Science (English program): Specialisatio	n Naval Architecture: Compulsory		
	General Engineering Science (English program, 7 semester): S	Specialisation Naval Architecture: Compuls	ory	
	Naval Architecture: Core qualification: Compulsory			

Course L1265: Resistance and Propulsion	
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Stefan Krüger
Language	DE
Cycle	WiSe
Content	
Literature	

Course L1266: Resistance and Propulsion		
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Stefan Krüger	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M1110: Ship Desigr	ı			
Courses		Turn	Hrobult	CD
Title		Typ Lecture	Hrs/wk	CP
Ship Design (L1262) Ship Design (L1264)		Recitation Section (large)	2	3 3
	Drof Stofan Krüger	hecitation Section (large)	2	5
	Prof. Stefan Krüger			
· ·	None			
Recommended Previous	Fluid Dynamics for Naval Architects, Resistance and I	Propulsion		
Knowledge	Resistance and Propulsion, Hydrostatics			
Educational Objectives	After taking part successfully, students have reached the follo	owing learning results		
Professional Competence				
	The lecture starts with an overview about the importance			
	thoroughly discussed. Typical bulding contracts and the re-			
	introduced and their influence on the competitiveness of a			
	performance of a ship design and the consecutive process			nple models or formula
	The student shall further learn to model complex systems pro	perly so that the relavent technical conclusion	s can be drawn.	
	The lecture continues with an introduction into the different pl	hases of design project, from the initial design	phase to a building o	contract. Further, method
	are introduced to generate bulding specfication relevant int			
	following topics are adressed:	0, 2,	0	0 0 ,
	- 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 principle	es of seagoing mearchant ships. The goal of t	he lecture is that the	student shall be able
	carry out a concept design based on a vessel of comparison			
	the basic design methods to determine the fundamantal tec			
	values. Based on the lecture "Principles of Ship Design" the r	relevant methods to determine and judge uopn	the performance of	a ship design are treate
Personal Competence				
	The students learns to prepare technical matters in such a wa	av the he can persuade his potantial customer	against his competite	ors.
	The students learns to prepare technical matters in such a wa			
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 semester		ry	
	General Engineering Science (English program): Specialisat	ion Naval Architecture: Compulsory		
	General Engineering Science (English program): Specialisat General Engineering Science (English program, 7 semester)		ry	

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	ourse 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 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 expertises 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				
Title		Тур	Hrs/wk	CP
Introduction into Process Engineering/Biop		Lecture	2	1
Fundamentals of material engineering (L08		Lecture	2	2
Module Responsible	Prof. Michael Schlüter			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reache	ed the following learning results		
Professional Competence				
Knowledge	After passing this module the students have the ab	ility to:		
	 give an overview of the most important field 	ts on process and bioprocess engineering		
	 explain some working methods for different 			
Skills	After passing this module the students should have	e the ability to:		
	 list and outline the most important fields of particular sectors. 	process engineering,		
		nes or methods of the different fields of process engin	neering,	
	 read and prepare an engineering drawing, 			
	 explain the most important technologies for 			
	 scheme typical chemical and biotechnologi 	ical processes independently with the aid of pointers	5.	
Personal Competence				
Social Competence	The students are able to			
	 work out results in groups and document th 	iem,		
	 provide appropriate feedback and handle feedback on their own performance constructively. 			
Autonomy		s of learning by themselves and to deliberate their	r lack of knowledge in F	Process Engineering a
	Bioprocess Engineering.			
Workload in Hours	Independent Study Time 34, Study Time in Lecture	56		
Credit points	3			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program):	Specialisation Process Engineering: Compulsory		
Curricula		Specialisation Bioprocess Engineering: Compulsory	/	
		7 semester): Specialisation Process Engineering: Co		
	General Engineering Science (German program, 7	semester): Specialisation Bioprocess Engineering:	Compulsory	
	Bioprocess Engineering: Core qualification: Comp	, , , , , ,		
		Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): S			
	0 0 0 0 0	semester): Specialisation Process Engineering: Col	mpulsory	
		semester): Specialisation Bioprocess Engineering:	1 3	
	Process Engineering: Core gualification: Compuls			



Course L0829: Introduction into Pro	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	terial engineering	
Тур	Lecture	
Hrs/wk		
CP	2	
Workload in Hours	dependent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Marko Hoffmann	
Language	DE	
Cycle	WiSe	
Content	 Introduction Atomic structure and bonding Structure of solids Miller indices Imperfections in solids Texture Diffusion Mechanical properties Dislocations and strengthening mechanisms Phase transformations Phase diagrams, iron-carbon phase diagram Metallic materials Corrosion Polymeric materials Ceramic materials 	
Literature	 Bargel, HJ.; Schulze, G. (Hrsg.): Werkstoffkunde. Berlin u.a., Springer Vieweg, 2012. Bergmann, W.: Werkstofftechnik 1. München u.a., Hanser, 2009. Bergmann, W.: Werkstofftechnik 2. München u.a., Hanser, 2008. Callister, W. D.; Rethwisch, D. G.: Materialwissenschaften und Werkstofftechnik: eine Einführung, Übersetzungshrsg.: Scheffler, M., 1. Auflage, Weinheim, Wiley-VCH, 2013. Seidel, W. W.,Hahn, F.: Werkstofftechnik. München u.a., Hanser, 2012. 	



Module M0937: Physical Cl	nemistry			
-	•			
Courses				
Title		Тур	Hrs/wk	CP
Physical Chemistry (L0833)		Lecture	2	2
Physical Chemistry (L0835)		Laboratory Course	2	1
Module Responsible	Prof. Hans-Ulrich Moritz			
Admission Requirements	None			
Recommended Previous	Contents of the previous modules inorganic chemistry, physics for e	engineers and mathematics I-III.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following I	earning 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-, hea	t- and momentum transfer.		
	- to interpret phase diagrams and affiliate kinetic rate laws.			
Skills	The students are able to			
	- conduct (fundamental) thermodynamical, electrochemical and kin	etic calculations.		
	- assess new applications with respect to environmental sustainab	ility.		
	- abstract their knowldege to related issues to conduct thermodynar	nical, electrochemical and kinetic cal	lculations.	
Personal Competence				
Social Competence	The students are able to plan, prepare, conduct and document experiments according to scientific guidelines in small groups.			
	The students are able to reflect their subject-specific knowledge or	ally in a team and to discuss it with fe	llow students and faculty	
Autonomy	Students are able to assess their knowldege continuously on their	own by exemplified practice. Studen	ts are able to apply their	knowldege discretely to
	plan, prepare and conduct experiments.			
Workload in Hours	Independent Study Time 34, Study Time in Lecture 56			
Credit points	3			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation Pr	ocess Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Bi	oprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semester): Spec	cialisation Bioprocess Engineering: E	Elective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program): Specialisation Program	ocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation Bio	oprocess Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Spec	ialisation Process Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester): Spec	ialisation Bioprocess Engineering: E	lective 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

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



Module M0536: Fundament	als of Fluid Mechanics			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Fluid Mechanics (L0091)		Lecture	2	4
Fluid Mechanics for Process Engineering	(L0092)	Recitation Section (large)	2	2
Module Responsible	Prof. Michael Schlüter			
Admission Requirements	None			
Recommended Previous	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	learning results		
Professional Competence	· · · · · · · · · · · · · · · · · · ·			
Knowledge	Students are able to:			
-				
	explain the difference between different types of flow	T		
	 give an overview for different applications of the Reynolds explain simplifications of the Continuity- and Navier-Stokes 			
	• explain simplifications of the Continuity- and Navier-Stokes	-Equation by using physical boundary	conditions	
Skills	The students are able to			
	 describe and model incompressible flows mathematically 			
	 reduce the governing equations of fluid mechanics by simplify 	olifications to archive quantitative solution	ons e.g. by integration	
	 notice the dependency between theory and technical appl 			
	use the learned basics for fluid dynamical applications in fi	elds of process engineering		
Personal Competence				
Social Competence	The students			
oobial oompelenee				
	 are capable to gather information from subject related, pro 			
	 able to work together on subject related tasks in small group and the subject related tasks in small group and tasks in small gr	ups. They are able to present their resul	ts effectively in English	(e.g. during small gro
	exercises)are able to work out solutions for exercises by themselves,	to discuss the solutions or ally and to pr	acont the results	
	• are able to work out solutions for exercises by themselves,	to discuss the solutions of any and to pr	esent the results.	
Autonomy	The students are able to			
	 search further literature for each topic and to expand their l 	snowledge with this literature.		
	 work on their exercises by their own and to evaluate their a 			
		č		
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 F	0 0 1 9		
Curricula	General Engineering Science (German program): Specialisation B General Engineering Science (German program): Specialisation B		Compulson	
	General Engineering Science (German program, 7 semester): Spe	с, с с	, ,	
	General Engineering Science (German program, 7 semester): Spe			
	General Engineering Science (German program, 7 semester): Spe			/
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Comp	ulsory		
	General Engineering Science (English program): Specialisation B			
	General Engineering Science (English program): Specialisation E	6, 6 6	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 Technomathematics: Specialisation III. Engineering Science: Elec		igineering: Compulsory	
	Process Engineering: Core qualification: Compulsory	avo oompuloory		



ourse L0091: Fundamentals of Flui	
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	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	1. Crowe, C. T.: Engineering fluid mechanics. Wiley, New York, 2009.
	2. Durst, F.: Strömungsmechanik: Einführung in die Theorie der Strömungen von Fluiden. Springer-Verlag, Berlin, Heidelberg, 2006.
	3. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994
	 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
	6. Kuhlmann, H.C.: Strömungsmechanik. München, Pearson Studium, 2007
	 Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2009
	8. Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007
	9. Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berlin, Heidelberg, 2008
	10. Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006
	11. van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882.
	12. White, F.: Fluid Mechanics, Mcgraw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011



Courses				
Title		Тур	Hrs/wk	CP
Thermodynamics III (L0114)		Lecture	2	2
Thermodynamics III (L0140)		Recitation Section (small)	1	2
Fhermodynamics 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				
Educational Objectives				
Educational Objectives Professional Competence	After taking part successfully, students have reached the follo	wing learning results		
Knowledge	 Starting from the very basics of thermodynamics, the s 	tudents learn the mathematical tools to descri	be thermodynamic e	quilibria.
	 They learn how state variables are influenced by the r 			
	 Moreover, the students learn how phase equilibria ca 			
			enomena may occur	n unierent priases (vaj
	liquid, solid) coexist in equilibrium. Furthermore the fu			
	 For different phase equilibria, several examples relevant 	ant for different kinds of processes are shown	and the necessary ki	nowledge for plotting
	interpreting the equilibria are taught.			
Skills	 Applying their knowledge, the students are able to id 	lentify the correct equation for the determinat	tion of the equilibriur	n state and know how
		lentity the confect equation for the determina		In state and know now
	simplify these equations meaningfully.	and a the second off the second and by the	- 119- 2	
	The students know models which can be used to def	ermine the properties of the system in the ec	quilibrium state and t	ney are able to solve
	resulting mathematical relations.			
	 For specific applications, they are able to self-reliantly 	find necessary physico-chemical properties	of compounds as wel	I as model parameter
	literature sources.			
	 Beside pure compound properties the students are ca 	pable of describing the properties of mixtures		
	 The students know how to visualize phase equilibria g 	raphically and they know how to interpret the	occurring phenomer	ia.
	 Based on their knowledge, the students are able to 	understand fundamental concepts that are	the basis for many	separation and reac
	processes in chemical engineering.		,	
	p			
Personal Competence				
Social Competence	The students are able to work in small groups, to solve the co	rresponding problems and to present them or	aly to the tutors and c	other students
Autonomy				
, laterionity	 The students are able to find necessary information set 	If-reliantly in literature sources and to judge the	neir quality.	
	During the semester the students are able to check the	eir learning progress continuously in exercise	es. Based on this kno	wledge the students
	adept their learning process.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination Examination duration and scale	Written exam 120 minutes; theoretical questions and calculations			
	,			
Assignment for the Following	General Engineering Science (German program): Specialisat			
Curricula	General Engineering Science (German program): Specialisat			
	General Engineering Science (German program, 7 semester)			
	General Engineering Science (German program, 7 semester)	: Specialisation Bioprocess Engineering: Con	npulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisati	on Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program, 7 semester):		sorv	
	General Engineering Science (English program, 7 semester):	opecialisation bioprocess Engineering: Com	puisory	
	Process Engineering: Core qualification: Compulsory			



Owners 10444 Thomas have a set	
Course L0114: Thermodynamics III	
Тур	
Hrs/wk	
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	SoSe
Content	
	 Introduction: Applications of thermodynamics of mixtures Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule Equations of state: virial equations, van-der-Waals equation, generalized equations of state Mixing properties: ideal and real mixtures, excess properties, partial molar properties Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition Gas-liquid-equilibria: equilibrium condition, Henry-coefficient G^E-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems Solid-liquid-equilibria: equilibrium condition, binary systems Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature Osmotic pressure
Literature	 Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997.J.P. O'Connell, J.M. Haile: Thermodynamics. Cambridge University Press, 2005.

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	 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 The students work on tasks in small groups and present their results in front of all students. Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997.J.P. O'Connell, J.M. Haile: Thermodynamics. Cambridge University Press, 2005.



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



Courses	
ïtle	Typ Hrs/wk CP
ignals and Systems (L0432)	Lecture 3 4
ignals and Systems (L0433)	Recitation Section (large) 1 2
Module Responsible	Prof. Gerhard Bauch
Admission Requirements	None
Recommended Previous	Mathematics 1-3
Knowledge	The modul is an introduction to the theory of signals and systems. Good knowledge in maths as covered by the moduls 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	Aller laking part addeessionly, suddents have reached the following rearining results
Knowledge	The students are able to classify and describe signals and linear time-invariant (LTI) systems using methods of signal and system theory. They are
U U	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse deterministic signals
	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	
	can analyse and design basic systems regarding important properties such as magnitude and phase response, stability, linearity etc They can a
Personal Competence	the impact of LTI systems on the signal properties in time and frequency domain.
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 level of kno
	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: Compu
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Anotal Osterna Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Foc
	Compulsory
	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 Electrical Engineering, Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation 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 Biomedical Engineering, Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compu
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
	Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engine
	Compulsory
	Computational Science and Engineering: Core qualification: Compulsory
	Mechatronics: Core qualification: Compulsory



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

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



ry and Microbiology			
	Түр	Hrs/wk	CP
		2	2
		1	1
	Lecture	2	2
	Problem-based Learning	1	1
Dr. Paul Bubenheim			
none			
none			
After taking part successfully, students have reach	hed the following learning results		
At the end of this module the students can:			
- explain the methods of biological and biochemic	cal research to determine the properties of biomolecules		
- name the basic components of a living organism	n		
- explain the principles of metabolism			
- describe the structure of living cells			
-			
The students are able.			
	ante		
- to divide a complex task into subtasks, solve the	se and to present the combined results		
The students are able to present the results of the	eir subtasks in a written report		
Independent Study Time 96, Study Time in Lectur	re 84		
6			
Written exam			
90 min			
General Engineering Science (German program)	: Specialisation Bioprocess Engineering: Compulsory		
General Engineering Science (German program,	7 semester): Specialisation Bioprocess Engineering: Con	npulsory	
Bioprocess Engineering: Core qualification: Com	pulsory		
General Engineering Science (English program):	Specialisation Bioprocess Engineering: Compulsory		
		pulsory	
	Dr. Paul Bubenheim none none After taking part successfully, students have reac At the end of this module the students can: - explain the methods of biological and biochemi - name the basic components of a living organism - explain the principles of metabolism - describe the structure of living cells - - describe the structure of living cells - - to gather knowledge in groups of about 10 stude - to introduce their own knowledge and to argue t - to divide a complex task into subtasks, solve the The students are able to present the results of the Independent Study Time 96, Study Time in Lectu 6 Written exam 90 min General Engineering Science (German program) General Engineering: Core qualification: Com General Engineering Science (English program):	Typ Lecture Problem-based Learning Lecture Problem-based Learning Lecture Problem-based Learning Lecture Problem-based Learning Dr. Paul Bubenheim none none After taking part successfully, students have reached the following learning results At the end of this module the students can: - explain the methods of biological and biochemical research to determine the properties of biomolecules - name the basic components of a living organism - explain the principles of metabolism - describe the structure of living cells - - - The students are able, - to gather knowledge in groups of about 10 students - to divide a complex task into subtasks, solve these and to present the combined results The students are able to present the results of their subtasks in a written report Independent Study Time 96, Study Time in Lecture 84 6 Written exam 90 min General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory <t< td=""><td>Typ Hrs/wk Lacture 2 Problem-based Learning 1 Lacture 2 Problem-based Learning 1 Lacture 2 Problem-based Learning 1 Dr. Paul Bubenheim 1 none 1 After taking part successfully, students have reached the following learning results 1 After taking part successfully, students have reached the following learning results 1 After taking part successfully, students have reached the following learning results 1 After taking part successfully, students have reached the following learning results 1 After taking part successfully, students have reached the following learning results 1 After taking part successfully, students have reached the following learning results 1 - explain the methods of biological and biochemical research to determine the properties of biomolecules - - ame the basic components of a living organism - - explain the principles of metabolism - - describe the structure of living cells - - to gather knowledge in groups of about 10 students - - to introduce their own knowledge and to argue their view in discussions</td></t<>	Typ Hrs/wk Lacture 2 Problem-based Learning 1 Lacture 2 Problem-based Learning 1 Lacture 2 Problem-based Learning 1 Dr. Paul Bubenheim 1 none 1 After taking part successfully, students have reached the following learning results 1 After taking part successfully, students have reached the following learning results 1 After taking part successfully, students have reached the following learning results 1 After taking part successfully, students have reached the following learning results 1 After taking part successfully, students have reached the following learning results 1 After taking part successfully, students have reached the following learning results 1 - explain the methods of biological and biochemical research to determine the properties of biomolecules - - ame the basic components of a living organism - - explain the principles of metabolism - - describe the structure of living cells - - to gather knowledge in groups of about 10 students - - to introduce their own knowledge and to argue their view in discussions



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

Course L0728: Biochemistry	
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



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

Course L0888: Microbiology	
Тур	Problem-based Learning
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Christian Schäfers
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



ourses				
itle		Тур	Hrs/wk	CP
troduction to Management (L0880)		Lecture Problem-based Learning	3 2	3 3
roject Entrepreneurship (L0882) Module Responsible	Prof. Christoph Ihl	Frobletti-based Learning	2	3
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following le	earning results		
Professional Competence				
Knowledge	After taking this module, students know the important basics of man Marketing and Innovation, and also to Investment and Controlling. In		nagement, from Planr	ning and Organisatior
	 explain the differences between Economics and Manageme field of Management 	nt and the sub-disciplines in Managem	ent and to name impo	ortant definitions from
	explain the most important aspects of and goals in Managem	nent and name the most important aspe	cts of entreprneurial p	orojects
	describe and explain basic business functions as production	on, procurement and sourcing, supply	chain management, o	organization and hur
	ressource management, information management, innovatio			
	explain the relevance of planning and decision making in arms basis methods from methometical Finance	Business, esp. in situations under mu	Itiple objectives and	uncertainty, and expl
	 some basic methods from mathematical Finance state basics from accounting and costing and selected control 	alling methods		
Skills	Students are able to analyse business units with respect to Entrepreneurship project in a team. In particular, they are able to	different criteria (organization, objec	tives, strategies etc.	.) and to carry out
	analyse Management goals and structure them appropriately	/		
	analyse organisational and staff structures of companies			
	apply methods for decision making under multiple objectives	, under uncertainty and under risk		
	analyse production and procurement systems and Business	information systems		
	analyse and apply basic methods of marketing			
	 select and apply basic methods from mathematical finance to apply basic methods from accounting, costing and controlling 			
	• apply basic methods from accounting, costing and controlling	g to prederined problems		
Personal Competence				
Social Competence	Students are able to			
	 work successfully in a team of students 			
	to apply their knowledge from the lecture to an entrepreneurs	ship project and write a coherent report	on the project	
	 to communicate appropriately and 			
	to cooperate respectfully with their fellow students.			
Autonomy	Students are able to			
	work in a team and to organize the team themselves			
	 to write a report on their project. 			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 Minuten			
Assignment for the Following	General Engineering Science (German program): Specialisation Ele	ectrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Co			
	General Engineering Science (German program): Specialisation Pro			
	General Engineering Science (German program): Specialisation Bio General Engineering Science (German program): Specialisation En		ampulcon	
	General Engineering Science (German program): Specialisation En			
	General Engineering Science (German program): Specialisation Me		inpuloory	
	General Engineering Science (German program): Specialisation Bio			
	General Engineering Science (German program): Specialisation Na	val Architecture: Compulsory		
	General Engineering Science (German program, 7 semester): Speci	ialisation Electrical Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester): Speci			
	General Engineering Science (German program, 7 semester): Speci	• •		
	General Engineering Science (German program, 7 semester): Speci		-	
	General Engineering Science (German program, 7 semester): Speci		•	
	General Engineering Science (German program, 7 semester): Speci			
	General Engineering Science (German program, 7 semester): Speci General Engineering Science (German program, 7 semester): Speci		-	v
				-
		Ialisation Mechanical Engineering Eco	ao moonanomoo. 001	
	General Engineering Science (German program, 7 semester): Speci		us Biomechanics: Co	mpulsorv
	General Engineering Science (German program, 7 semester): Speci General Engineering Science (German program, 7 semester): Speci	ialisation Mechanical Engineering, Foc		
	General Engineering Science (German program, 7 semester): Speci	alisation Mechanical Engineering, Foc ialisation Mechanical Engineering, Foc	us Aircraft Systems E	ngineering: Compulso
	General Engineering Science (German program, 7 semester): Speci General Engineering Science (German program, 7 semester): Speci General Engineering Science (German program, 7 semester): Speci	alisation Mechanical Engineering, Foc ialisation Mechanical Engineering, Foc	us Aircraft Systems E	ngineering: Compulso
	General Engineering Science (German program, 7 semester): Speci General Engineering Science (German program, 7 semester): Speci General Engineering Science (German program, 7 semester): Speci General Engineering Science (German program, 7 semester): S	ialisation Mechanical Engineering, Foc ialisation Mechanical Engineering, Foc pecialisation Mechanical Engineering	us Aircraft Systems E J, Focus Materials in	ngineering: Compulson Engineering Science



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



	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. Wolfgar
	Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	 Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management Important definitions from Management, Developing Objectives for Business, and their relation to important Business functions Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management Marketing and Sales Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management Definitions as information, information systems, aspects of data security and strategic information systems Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. Relevance of marketing, B2B vs. B2C-Marketing different techniques from the field of marketing (e.g. scenario technique), pricing strategies important organizational structures basics of human ressource management Introduction to Business Planning and the steps of a planning process Decision Analysis: Elements of decision problems and methods for solving decision problems Selected Planning Tasks, e.g. Investment and Financial Decisions Introduction to Accounting: Accounting, Balance-Sheets, Costing Relevance of Controlling and selected Controlling methods
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 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		Тур	Hrs/wk	CP
Bioprocess Engineering - Fundamentals (I		Lecture	2	3
Bioprocess Engineering- Fundamentals (L		Recitation Section (large)	2	1
Bioprocess Engineering - Fundamental Pra		Laboratory Course	2	2
Module Responsible	Prof. Andreas Liese			
Admission Requirements	none			
Recommended Previous	none, module "organic chemistry", module "fundamentals for process engineering"			
Knowledge				
Educational Objectives	After taking part successfully, students have reac	ned the following learning results		
Professional Competence				
Knowledge	Students are able to describe the basic conce	pts of bioprocess engineering. They are able to classi	ify different types of	kinetics for enzymes a
	microorganisms, as well as to differentiate	ent types of inhibition. The parameters of stoichiometry a	nd rheology can be n	amed and mass transp
	processes in bioreactors can be explained. The	e students are capable to explain fundamental bioproc	ess management, ste	erilization technology a
	downstream processing in detail.			
01-11-				
Skills	After successful completion of this module, stude	Its should be able to		
	describe different kinetic approaches for g	prowth and substrate-uptake and to calculate the correspo	onding parameters	
	 predict qualitatively the influence of energy 	y generation, regeneration of redox equivalents and gro	wth inhibition on the fe	ermentation process
	analyze bioprocesses on basis of stoichio	metry and to set up / solve metabolic flux equations		
	distinguish between scale-up criteria for c	lifferent bioreactors and bioprocesses (anaerobic, aerob	ic as well as microaei	robic) to compare them
	well as to apply them to current biotechnic	al problem		
	 propose solutions to complicated biotechi 	nological problems and to deduce the corresponding mo	dels	
	 to explore new knowledge resources and 			
	 identify scientific problems with concrete i 			
	 to document and discuss their procedures 	as well as results in a scientific manner		
Personal Competence				
Social Competence	After completion of this module participants should	uld be able to debate technical questions in small teams	s to enhance the abili	ity to take position to th
	own opinions and increase their capacity for team	nwork in engineering and scientific environments.		
Autonomic	After completion of this module participants will	be able to asly a technical problem in a team inder	andontly by organizi	ing their workflow and
Autonomy		be able to solve a technical problem in a team indep	bendenliy by organizi	ing their worklow and
	present their results in a plenum.			
Workload in Hours				
	present their results in a plenum. Independent Study Time 96, Study Time in Lectur	e 84		
Credit points	Independent Study Time 96, Study Time in Lectur 6	re 84		
Credit points Examination	Independent Study Time 96, Study Time in Lectur 6 Written exam	re 84		
Credit points Examination Examination duration and scale	Independent Study Time 96, Study Time in Lectu 6 Written exam 90 min			
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectu 6 Written exam 90 min General Engineering Science (German program)	: Specialisation Process Engineering: Compulsory		
Credit points Examination Examination duration and scale	Independent Study Time 96, Study Time in Lectu 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program)	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory	11507/	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectu 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program) General Engineering Science (German program,	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp		
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectu 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program, General Engineering Science (German program, General Engineering Science (German program,	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp 7 semester): Specialisation Bioprocess Engineering: Co		
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectu 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program, General Engineering Science (German program, General Engineering Science (German program, Bioprocess Engineering: Core qualification: Com	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp 7 semester): Specialisation Bioprocess Engineering: Co pulsory		
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectur 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program, General Engineering Science (German program, Bioprocess Engineering: Core qualification: Com General Engineering Science (English program)	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp 7 semester): Specialisation Bioprocess Engineering: Co pulsory : Specialisation Bioprocess Engineering: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectur 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program, General Engineering Science (German program, Bioprocess Engineering: Core qualification: Com General Engineering Science (English program) General Engineering Science (English program)	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp 7 semester): Specialisation Bioprocess Engineering: Co pulsory : Specialisation Bioprocess Engineering: Compulsory : Specialisation Process Engineering: Compulsory	mpulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectur 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program, General Engineering Science (German program, Bioprocess Engineering: Core qualification: Com General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program)	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp 7 semester): Specialisation Bioprocess Engineering: Co pulsory : Specialisation Bioprocess Engineering: Compulsory : Specialisation Process Engineering: Compulsory 7 semester): Specialisation Process Engineering: Compulsory	mpulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectur 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program, General Engineering Science (German program, Bioprocess Engineering: Core qualification: Com General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program, General Engineering Science (English program,	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp 7 semester): Specialisation Bioprocess Engineering: Co pulsory : Specialisation Bioprocess Engineering: Compulsory : Specialisation Process Engineering: Compulsory 7 semester): Specialisation Process Engineering: Compu 7 semester): Specialisation Bioprocess Engineering: Comp	mpulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectur 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program, General Engineering Science (German program, Bioprocess Engineering: Core qualification: Com General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program, General Engineering Science (English program, General Engineering Science (English program, Biomedical Engineering: Specialisation Artificial	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp 7 semester): Specialisation Bioprocess Engineering: Co pulsory : Specialisation Bioprocess Engineering: Compulsory : Specialisation Process Engineering: Compulsory 7 semester): Specialisation Process Engineering: Compu 7 semester): Specialisation Bioprocess Engineering: Compu 9 semester): Specialisation Bioprocess Engineering: Compu 9 semester): Specialisation Bioprocess Engineering: Compu	mpulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectur 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program) General Engineering Science (German program, General Engineering Science (German program, Bioprocess Engineering: Core qualification: Com General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program, General Engineering Science (English program, General Engineering Science (English program, Biomedical Engineering: Specialisation Artificial Biomedical Engineering: Specialisation Implants	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp 7 semester): Specialisation Bioprocess Engineering: Co pulsory : Specialisation Bioprocess Engineering: Compulsory : Specialisation Process Engineering: Compulsory 7 semester): Specialisation Process Engineering: Compu 7 semester): Specialisation Bioprocess Engineering: Compu 9 and Regenerative Medicine: Compulsory and Endoprostheses: Elective Compulsory	mpulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectur 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program) General Engineering Science (German program, General Engineering Science (German program, Bioprocess Engineering: Core qualification: Com General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program, Biomedical Engineering: Specialisation Artificial Biomedical Engineering: Specialisation Implants Biomedical Engineering: Specialisation Medical	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp 7 semester): Specialisation Bioprocess Engineering: Co pulsory : Specialisation Bioprocess Engineering: Compulsory : Specialisation Process Engineering: Compulsory 7 semester): Specialisation Process Engineering: Compu 7 semester): Specialisation Bioprocess Engineering: Comp 7 and Regenerative Medicine: Compulsory 8 and Endoprostheses: Elective Compulsory 8 Technology and Control Theory: Elective Compulsory	mpulsory	
Credit points Examination Examination duration and scale Assignment for the Following	Independent Study Time 96, Study Time in Lectur 6 Written exam 90 min General Engineering Science (German program) General Engineering Science (German program) General Engineering Science (German program, General Engineering Science (German program, Bioprocess Engineering: Core qualification: Com General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program) General Engineering Science (English program, Biomedical Engineering: Specialisation Artificial Biomedical Engineering: Specialisation Implants Biomedical Engineering: Specialisation Medical	: Specialisation Process Engineering: Compulsory : Specialisation Bioprocess Engineering: Compulsory 7 semester): Specialisation Process Engineering: Comp 7 semester): Specialisation Bioprocess Engineering: Co pulsory : Specialisation Bioprocess Engineering: Compulsory : Specialisation Process Engineering: Compulsory 7 semester): Specialisation Process Engineering: Compu 7 semester): Specialisation Bioprocess Engineering: Compu 9 and Regenerative Medicine: Compulsory and Endoprostheses: Elective Compulsory Technology and Control Theory: Elective Compulsory ment and Business Administration: Elective Compulsory	mpulsory	



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

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

Course L0843: Bioprocess Engineering - Fundamental Practical Course		
Тур	Laboratory Course	
Hrs/wk	2	
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			
Courses			Unadada	0.0
Title Heat and Mass Transfer (L0101)	Typ Lectu	re	Hrs/wk	CP 4
Heat and Mass Transfer (L0102)		ation 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 learning result	3		
Professional Competence Knowledge				
Skills	 The students are capable of explaining qualitative and determining quarchemical reactors). They are capable of distinguish and characterize different kinds of heat tradiation. The students have the ability to explain the physical basis for mass transfer using suitable mass transfer theories. They are able to depict the analogy between heat- and mass transfer and The students are able to set reasonable system boundaries for a given corresponding energy and mass flow, respectively. They are capable to solve specific heat transfer problems (e.g. heated or corresponding heat flows. Using dimensionless quantities, the students can execute scaling up of ter They are able to distinguish between diffusion, convective mass transitic and design of apparatus (e.g. extraction column, rectification column). In this context, the students are capable to choose and design funda considering their advantages and disadvantages, respectively. 	ansfer mechanisms nam er in detail and to describ to describe complex linke transport problem by us chemical reactors, tempe chnical processes or app on and mass transfer. Th	hely heat conduction, h be mass transfer qualita ed processes in detail. ing the gained knowle rature alteration in flui aratus. ley can use this knowle	eat transfer and therm ative and quantitative l dge and to balance th ds) and to calculate th edge for the description
Personal Competence Social Competence	 In addition, they can calculate both, steady-state and non-steady-state pro The students are capable to connect their knowledge obtained in this thermodynamics, fluid mechanics and chemical process engineering) to s The students are capable to work on subject-specific challenges in teams other students. 	s course with knowlego	de of other courses (Ir rroblems.	
Autonomy	 The students are able to find and evaluate necessary information from suit They are able to prove their level of knowledge during the course w assignments) and on this basis they can control their learning processes. 		edure continuously (cl	icker-system, exam-lii
Workload in Hours	Independent Study Time 138, Study Time in Lecture 42			
Credit points	6			
Examination	Written exam			
Examination duration and scale				
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation Process Engine General Engineering Science (German program): Specialisation Bioprocess Engi	• • •		
Curricula	General Engineering Science (German program): Specialisation bioprocess Engi General Engineering Science (German program): Specialisation Energy and Env		Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Program			
	General Engineering Science (German program, 7 semester): Specialisation Biop	process Engineering: Co	mpulsory	
	General Engineering Science (German program, 7 semester): Specialisation Ene	rgy and Enviromental En	igineering: Compulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Bioprocess Engin		ompulson	
	General Engineering Science (English program): Specialisation Energy and Envi General Engineering Science (English program): Specialisation Process Engineer		ompulsory	
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering		Ilsory	
	General Engineering Science (English program, 7 semester): Specialisation Fioe			
	General Engineering Science (English program, 7 semester): Specialisation Ener	gy and Enviromental En	gineering: Compulsory	
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsor	/		
	Technomathematics: Core qualification: Elective Compulsory			
	Process Engineering: Core qualification: Compulsory			



Course L0101: Heat and Mass Trans	sfer
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 Mass transfer one-way diffusion, equimolar countercurrent diffusion boundary layer theory, non-steady mass transfer Heat and mass transfer single particle/ fixed bed Mass transfer and chemical reactions
Literature	 H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer VDI-Wärmeattas

Typ Recitation Se Hrs/wk 1 CP 2	ection (small) t Study Time 46, Study Time in Lecture 14
CP 2	t Study Time 46. Study Time in Lecture 14
	t Study Time 46. Study Time in Lecture 14
Wentsteed in Lleune Independent	t Study Time 46. Study Time in Lecture 14
workload in Hours Independent	
Lecturer Prof. Irina Sn	nirnova
Language DE	
Cycle WiSe	
Literature	 Introduction, one-dimensional heat conduction Convective heat transfer Multidimensional heat conduction Non-steady heat conduction Thermal radiation



Courses					
itle		Тур	Hrs/wk	CP	
hermal Separation Processes (L0118)			3 2	3	
hermal Separation Processes (L0119) hermal Separation Processes (L0141)		Recitation Section (small) Recitation Section (large)	2	1	
eparation Processes (L1159)		Laboratory Course	1	1	
Module Responsible	Prof. Irina Smirnova				
Admission Requirements	None				
Recommended Previous	Recommended requirements: Thermodynamics III				
Knowledge					
Educational Objectives	After taking part successfully, students have reached the following	g learning results			
Professional Competence					
Knowledge	 The students can distinguish and describe different type. 	of concretion processes such as distillation	n avtraction and ad	aration	
	The students can distinguish and describe different types The students develop on understanding for the sources				
	• The students develop an understanding for the course of concentration during a separation process, the estimation of the energy demand of				
	process, the possibilities of energy saving, and the selec				
	 They have good knowledge of designing methods for se 	Saration processes and devices			
Skills	 Using the gained knowledge the students can select a result. 	acapable system boundary for a given sor	aration process and	can aloca the access	
	Using the gained knowledge the students can select a re	asonable system boundary for a given sep	aration process and	can close the associa	
	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 se 	paration process for a given case based of	on the advantages a	ind disadvantages of	
	process				
	The students are capable to obtain independently the needed material properties from appropriate sources (diagrams and tables)				
	They can calculate continuous and discontinuous processes				
	The students are able to prove their theoretical knowledge in the experimental lab work.				
	 The students are able to discuss the theoretical background and the content of the experimental work with the teachers in colloquium. 				
	The students are capable of linking their gained knowledge with the content of other lectures and use it together for the solution of technical problem				
	Other lectures such as thermodynamics, fluid mechanics and ch	emical engineering.			
Personal Competence					
Social Competence	 The students can work technical assignments in small gr 	ours and present the combined results in t	ne tutorial		
	 The students can work technical assignments in small gr 	sups and present the combined results in th	ie lutoriai		
	 The students are able to carry out practical lab work in students 	mall groups and organize a functional div	sion of labor betwee	n them. They are able	
	discuss their results and to document them scientifically		SIGH OF IADOF DELWEE	in them. They are able	
	discuss their results and to document them scientificarly	na lepon.			
Autonomy					
	The students are capable to obtain the needed information	,	1 3		
	The students can proof the state of their knowledge with exam resembling assignments and in this way control their learning process				
Workload in Hours	Independent Study Time 82, Study Time in Lecture 98				
Credit points Examination	6 Written exam				
Examination duration and scale	120 minutes; theoretical guestions and calculations				
		Dreeses Englisseries Computers			
Assignment for the Following	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation				
Curricula		1 0 0 1 ,			
	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	pecialisation Energy and Enviromental Eng	Ineering: Compulso	У	
	Bioprocess Engineering: Core qualification: Compulsory				
	Energy and Environmental Engineering: Core qualification: Con				
	General Engineering Science (English program): Specialisation	Bioprocess Engineering: Compulsory			
	General Engineering Science (English program): Specialisation	Energy and Enviromental Engineering: Co	mpulsory		
	General Engineering Science (English program): Specialisation	Process Engineering: Compulsory			
	General Engineering Science (English program, 7 semester): Sp	ecialisation Process Engineering: Compul	sory		
	General Engineering Science (English program, 7 semester): Sp	ecialisation Bioprocess Engineering: Com	pulsory		
	General Engineering Science (English program, 7 semester): S	ecialisation Energy and Enviromental Eng	ineering: Compulsor	y	



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			
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkop Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.C. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann Enzyklopådie der Technischen Chemie 		



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. Steinkoj Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry"s Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann Enzyklopädie der Technischen Chemie



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



ourse L1159: Separation Process	
Тур	Laboratory Course
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Course work	Compulsory attendence of the colloquia of all experiments and compulsory report.
Lecturer	Prof. Irina Smirnova
Language	DE/EN
Cycle	SoSe
Content	The students work on eight different experiments in this practical course. For every one of the eight experiments, a colloquium takes place in which 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 is the students with a high degree of division of labor. For every experiment, the students write a report. They receive instructions is the students with the students with a high degree of division of labor.
	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 Advance overview of separation processes Advance overview of separation processes Selection of separation processes
Literature	 G. Brunner: Skriptum Thermische Verfahrenstechnik J. King: Separation Processes, McGraw-Hill, 2. Aufl. 1980 Sattler: Thermische Trennverfahren, VCH, Weinheim 1995 J.D. Seader, E.J. Henley: Separation Process Principles, Wiley, New York, 1998. Mersmann: Thermische Verfahrenstechnik, Springer, 1980 Grassmann, Widmer, Sinn: Einführung in die Thermische Verfahrenstechnik, 3. Aufl., Walter de Gruyter, Berlin 1997 Brunner, G.: Gas extraction. An introduction to fundamentals of supercritical fluids and the application to separation processes. Steinkop Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1; ISBN 0-387-91477-3. R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006. Perry's Chemical Engineers'' Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann Enzyklopădie der Technischen Chemie



Module M0892: Chemical R	eaction Engineering				
	eaction Engineering				
Courses					
Title		Тур	Hrs/wk	CP	
Chemical Reaction Engineering (Fundame	ntals) (L0204)	Lecture	2	2	
Chemical Reaction Engineering (Fundame	ntals) (L0244)	Recitation Section (large)	2	2	
Experimental Course Chemical Engineerin	g (Fundamentals) (L0221)	Laboratory Course	2	2	
Module Responsible	Prof. Raimund Horn				
Admission Requirements	None				
Recommended Previous	Contents of the previous modules mathematics I-II	I, physical chemistry, technical thermodynamics I+II as w	ell as computational r	nethods for engineers.	
Knowledge					
Educational Objectives	After taking part successfully, students have reach	ed the following learning results			
Professional Competence					
Knowledge	The students are able to explain basic concepts o	f chemical reaction engineering. They are able to point	out differences betwe	en thermodynamical a	
	kinetical processes. The students have a strong ability to outline parts of isothermal and non-isothermal ideal reactors and to describe their properties.				
Skills	After successful completion of the module, students are able to:				
	- apply different computational methods to dimension isothermal and non-isothermal ideal reactors,				
	- determine and compute stable operation points for these reactors ,				
	- conduct experiments on a lab-scale pilot plants and document these according to scientific guidelines.				
Personal Competence					
Social Competence	After successful completition of the lab-course th	e students have a strong ability to organize themselfe	s in small groups to	solve issues in chemic	
	reaction engineering. The students can discuss the	eir subject related knowledge among each other and wit	h their teachers.		
Autonomy	The students are able to obtain further information	on and assess their relevance autonomously. Students	autonomously. Students can apply their knowldege discretely to pla		
	prepare and conduct experiments.				
Workload in Hours	Independent Study Time 96, Study Time in Lecture	e 84			
Credit points	6				
Examination	Written exam				
Examination duration and scale	120 min				
Assignment for the Following	General Engineering Science (German program):	Specialisation Process Engineering: Compulsory			
Curricula					
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory				
	Bioprocess Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory				
	Process Engineering: Core qualification: Compuls	sory			

Course L0204: Chemical Reaction B	Engineering (Fundamentals)
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Raimund Horn
Language	DE
Cycle	WiSe
Content	Fundamentals of chemical reaction engineering, definitions, calculation of species concentrations (reactor, reaction mixture, reactants, products, inerts and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentration, mass- concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, conversion, selectivity, yield, concentration calculations in stationary and flowing multicomponent-mixtures) Stoichiometry and stoichiometric calculations (simple reactions, complex reactions, key reactions, key species, matrix of stoichiometric coefficients, linear dependent and independent reactions, element-species-matrix, row reduced form of a matrix, rank of a matrix, Gauss Jordan elimination, relation between stoichiometry and kinetics, calculating the extent of reaction from mole number changes in complex reactions) Thermodynamics (What is thermodynamics?, importance of thermodynamics in chemical reaction engineering, zeroth law of thermodynamics, temperature scales, temperature measurements in praxis, first law of thermodynamics, internal energy, enthalpy, calorimeter, heat of reaction, standard heat of formation, Hess law, heat capacity, Kirchhoff law, standard heat of reaction, pressure dependence of the heat of reaction, second law of thermodynamics, reversible and irreversible processes, entropy, Clausius inequality, free energy, Gibbs Energy, chemical potential, chemical equilibrium, activity, van't Hoff law, calculation of chemical equilibrium, principle of Le Chatelier and Braun, equilibrium calculations in multiple reaction systems, Lagrange Multipliers)
	Chemical kinetics (reversible and irreversible reactions, homogeneous and heterogeneous reactions, elementary step, reaction mechanism, microkinetics, macrokinetics, formal kinetics, reaction rate, rate of change of species mole number, Arrhenius-equation, activation energy and pre- exponential factor for komplex reactions, reactions of 0., 1. and 2. order, analytical integration of rate laws, Damköhler-number, differential and integral method of kinetic analysis, laboratory reactors for kinetic measurements, half life, kinetics of complex reactions, parallel reactions, reversible reactions, sequence of reactions, irreversible reaction with pre-equilibrium, reduction of reaction mechanisms, quasi-stationarity principle of Bodenstein, rate limiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of complex kinetics) Types of chemical Reaktors (chemical reactors in industry and laboratory, ideal vs. real reaktors, discontinuous, half continuous and continuous reactors,



	single phase - biphasic- and multiphase reactors, batch-reactor, semi-batch reactor, CSTR, Plug Flow reactor, fixed bed reactor, adiabatic staged reactors, rotating furnaces, fluidized bed reactors, gas-liquid-reactors, multi-phase reactors)		
	Isothermal ideal reactors (mole-balance of a chemical reactor, mole balance of a batch reactor, integration of the batch reactor mole balance for various kinetics, partial fraction decomposition, mole balance of the semi-batch reactor, mole balance of the plug flow reactor, analogy batch reactor - plug flow reactor, design of plug flow reactors for reactions with volume change and complex reactions, mole balance of a fixed bed reactor, design of a membrane reactor, mole balance of a continuously stirred tank reactor, comparison of CSTR and PFR with respect to conversion and selectivity, mole-balance of a cascade of tank reactors, numerical-interative calculation of a cascade of tank reactors, Newton-Raphson method, graphical analysis of a cascade of tank reactors)		
non-isothermal ideal reactors (energy balance of a reactor, adiabatic reactor, adiabatic temperature rise, staged reactor for adiabatic ex reactions limited by chemical equilibrium, design of an adiabatic plug flow reactor, Levenspiel-plots, heat transfer through a reactor wall, heat tra- convection, heat conduction, heat transfer through a cylindrical wall, design of a plug flow reactor in parallel and counter flow, heat balance cooling fluid, CSTR with heat exchange, multiple stationary states, ignition-extinction behavior, stability of a CSTR, complex reactions in non-iso reactors, optimum temperature profile of a reactor)			
Literature	lecture notes Raimund Horn		
	skript Frerich Keil		
	Books:		
	M. Baerns, A. Behr, A. Brehm, J. Gmehling, H. Hofmann, U. Onken, A. Renken, Technische Chemie, Wiley-VCH		
	G. Emig, E. Klemm, Technische Chemie, Springer		
A. Behr, D. W. Agar, J. Jörissen, Einführung in die Technische Chemie			
E. Müller-Erlwein, Chemische Reaktionstechnik 2012, 2. Auflage, Teubner Verlag			
J. Hagen, Chemiereaktoren: Auslegung und Simulation, 2004, Wiley-VCH			
	H. S. Fogler, Elements of Chemical Reaction Engineering, Prentice Hall B		
	H. S. Fogler, Essentials of Chemical Reaction Engineering, Prentice Hall		
	O. Levenspiel, Chemical Reaction Engineering, John Wiley & Sons, 1998		
	L. D. Schmidt, The Engineering of Chemical Reactions, Oxford Univ. Press, 2009		
	J. B. Butt, Reaction Kinetics and Reactor Design, 2000, Marcel Dekker		
	R. Aris, Elementary Chemical Reactor Analysis, Dover Pubn. Inc., 2000		
	M. E. Davis, R. J. Davis, Fundamentals of Chemical Reaction Engineering, McGraw Hill		
	G. F. Froment, K. B. Bischoff, J. De Wilde, Chemical Reactor Analysis and Design, John Wiley & Sons, 2010		
	A. Jess, P. Wasserscheid, Chemical Technology An Integrated Textbook, WILEY-VCH		



rse L0244: Chemical Reaction E	
	Recitation Section (large)
	2
	2
	Independent Study Time 32, Study Time in Lecture 28
	Prof. Raimund Horn, Dr. Oliver Korup
0 0	DE
-	
Content	Fundamentals of chemical reaction engineering, definitions, calculation of species concentrations (reactor, reaction mixture, reactants, products, in and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentration, ma concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, conversi 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, lin dependent and independent reactions, element-species-matrix, row reduced form of a matrix, rank of a matrix, Gauss Jordan elimination, rela between stoichiometry and kinetics, calculating the extent of reaction from mole number changes in complex reactions)
	Thermodynamics (What is thermodynamics?, importance of thermodynamics in chemical reaction engineering, zeroth law of thermodynamic temperature scales, temperature measurements in praxis, first law of thermodynamics, internal energy, enthalpy, calorimeter, heat of reaction, stand heat of formation, Hess law, heat capacity, Kirchhoff law, standard heat of reaction, pressure dependence of the heat of reaction, second law thermodynamics, reversible and irreversible processes, entropy, Clausius inequality, free energy, Gibbs Energy, chemical potential, chem equilibrium, activity, van't Hoff law, calculation of chemical equilibrium, principle of Le Chatelier and Braun, equilibrium calculations in multiple reac systems, Lagrange Multipliers)
	Chemical kinetics (reversible and irreversible reactions, homogeneous and heterogeneous reactions, elementary step, reaction mechan microkinetics, macrokinetics, formal kinetics, reaction rate, rate of change of species mole number, Arrhenius-equation, activation energy and exponential factor for komplex reactions, reactions of 0., 1. and 2. order, analytical integration of rate laws, Damköhler-number, differential and interested of kinetic analysis, laboratory reactors for kinetic measurements, half life, kinetics of complex reactions, parallel reactions, reversible reaction sequence of reactions, irreversible reaction with pre-equilibrium, reduction of reaction mechanisms, quasi-stationarity principle of Bodenstein, limiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of com kinetics)
	Types of chemical Reaktors (chemical reactors in industry and laboratory, ideal vs. real reaktors, discontinuous, half continuous and continuous reac single phase - biphasic- and multiphase reactors, batch-reactor, semi-batch reactor, CSTR, Plug Flow reactor, fixed bed reactor, adiabatic sta reactors, rotating furnaces, fluidized bed reactors, gas-liquid-reactors, multi-phase reactors)
	Isothermal ideal reactors (mole-balance of a chemical reactor, mole balance of a batch reactor, integration of the batch reactor mole balance for var kinetics, partial fraction decomposition, mole balance of the semi-batch reactor, mole balance of the plug flow reactor, analogy batch reactor - plug reactor, design of plug flow reactors for reactions with volume change and complex reactions, mole balance of a fixed bed reactor, design membrane reactor, mole balance of a continuously stirred tank reactor, comparison of CSTR and PFR with respect to conversion and selectivity, m balance of a cascade of tank reactors, numerical-interative calculation of a cascade of tank reactors, Newton-Raphson method, graphical analysis cascade of tank reactors)
	non-isothermal ideal reactors (energy balance of a reactor, adiabatic reactor, adiabatic temperature rise, staged reactor for adiabatic exothe reactions limited by chemical equilibrium, design of an adiabatic plug flow reactor, Levenspiel-plots, heat transfer through a reactor wall, heat transfer convection, heat conduction, heat transfer through a cylindrical wall, design of a plug flow reactor in parallel and counter flow, heat balance of cooling fluid, CSTR with heat exchange, multiple stationary states, ignition-extinction behavior, stability of a CSTR, complex reactions in non-isother reactors, optimum temperature profile of a reactor)
Literature	lecture notes Raimund Horn
	skript Frerich Keil
	Books:
	M. Baerns, A. Behr, A. Brehm, J. Gmehling, H. Hofmann, U. Onken, A. Renken, Technische Chemie, Wiley-VCH
	G. Emig, E. Klemm, Technische Chemie, Springer
	A. Behr, D. W. Agar, J. Jörissen, Einführung in die Technische Chemie
	E. Müller-Erlwein, Chemische Reaktionstechnik 2012, 2. Auflage, Teubner Verlag
	J. Hagen, Chemiereaktoren: Auslegung und Simulation, 2004, Wiley-VCH
	H. S. Fogler, Elements of Chemical Reaction Engineering, Prentice Hall B
	H. S. Fogler, Essentials of Chemical Reaction Engineering, Prentice Hall
	O. Levenspiel, Chemical Reaction Engineering, John Wiley & Sons, 1998
	L. D. Schmidt, The Engineering of Chemical Reactions, Oxford Univ. Press, 2009
	J. B. Butt, Reaction Kinetics and Reactor Design, 2000, Marcel Dekker
	R. Aris, Elementary Chemical Reactor Analysis, Dover Pubn. Inc., 2000
	M. E. Davis, R. J. Davis, Fundamentals of Chemical Reaction Engineering, McGraw Hill



Тур	Laboratory Course		
Hrs/wk			
CP			
Workload in Hours	ependent 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 bas 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, that they can improve their competence in this field over the course of the practical course.		
Literature	Levenspiel, O.: Chemical reaction engineering; John Wiley & Sons, New York, 3. Ed., 1999 VTM 309(LB)		
	Praktikumsskript		
	Skript Chemische Verfahrenstechnik 1 (F.Keil)		



Courses					
litle		Тур	Hrs/wk	CP	
Bioprocess Engineering - Advanced (L11)		Lecture	2	4	
Bioprocess Engineering - Advanced (L11)		Recitation Section (small)	2	2	
Module Responsible					
Admission Requirements	none				
Recommended Previous	Content of module "Biochemical Engineering	"			
Knowledge					
Educational Objectives	After taking part successfully, students have re	eached the following learning results			
Professional Competence		dente cher della schlada			
Knowledge	After successful completion of this module, stu	idents should be able to			
	describe and explain different kinetic a	approaches for growth and substrate-uptake			
	identification of scientific problems wi	th concrete industrial use (cultivation of microorganisms a	nd mammalian cells)		
	describe and explain important down	streaming steps for proteins and their application as well a	is basic immobilization n	nethods	
Skills	After successful completion of this module, stu	udents should be able to			
	- to identify scientific questions or possible r	practical problems for concrete industrial applications (eq	cultivation of microorga	anisms and animal cel	
	- to identify scientific questions or possible practical problems for concrete industrial applications (eg cultivation of microorganisms and animal cell and to formulate solutions,				
	- To assess the application of scale-up criteria for different types of bioreactors and processes and to apply these criteria to given problems (anaerob aerobic or microaerobically)				
	- to formulate questions for the analysis and optimization of real biotechnological production processes appropriate solutions ,				
	- To describe the effects of the energy generation, the regeneration of reduction equivalents , and the growth inhibition of the behavior of microorganism and to the total fermentation process qualitatively				
	 Establish material flow balance equations a and activity yields , 	and solve them to determine the kinetic parameters of diffe	erent approaches and to) calculate immobilizati	
	- to select process control strategies (batch , f	ed-batch , continuity) appropriately and to calculate basic	types 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 ability to take position to the own opinions and increase their capacity for teamwork.				
Autonomy	After completion of this module participants are able to aquire new sources of knowledge and apply their knowledge to previously unknown issue to present these.				
Workload in Hours	Independent Study Time 124, Study Time in L	ecture 56			
Credit points	6				
Examination	Written exam				
Examination duration and scale	90 min				
Assignment for the Following	General Engineering Science (German progr	am): Specialisation Bioprocess Engineering: Compulsory			
Curricula		am, 7 semester): Specialisation Bioprocess Engineering: (Compulsory		
	Bioprocess Engineering: Core qualification: Compulsory				
	Conorol Engineering Spience (English progra	am): Specialisation Bioprocess Engineering: Compulsory			
	General Engineering Science (English progra				
		am, 7 semester): Specialisation Bioprocess Engineering: C	ompulsory		
		am, 7 semester): Specialisation Bioprocess Engineering: C	Compulsory		



Course L1107: Bioprocess Enginee	ring - Advanced		
Тур	Lecture		
Hrs/wk			
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 02-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 		



Module M0539: Process an	d Plant Engineering I				
0					
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	receitation occurr (small)	•	L	
Admission Requirements	none				
Recommended Previous					
Knowledge	nit operation of thermal an dmechanical separation processes				
Kilomeuge	chemical reactor eingineering				
Educational Objectives	After taking part successfully, students have reached the following	learning results			
Professional Competence					
Knowledge	students can:				
	classify and formulate blobal balance equations of chemical proc	esses			
	specify linear component equations of complex chemical process	es			
	explain linear regression and data reconcilliation problems				
	explain pfd-diagrams				
Skills	students are capable of				
	- 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 product	on costs			
Personal Competence					
Social Competence					
Autonomy					
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56				
Credit points	6				
Examination	Written exam				
Examination duration and scale	120 Min. lectures notes and books				
Assignment for the Following	General Engineering Science (German program): Specialisation	Process Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisation	Bioprocess Engineering: Compulsory			
	General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Compu	lsory		
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory				
	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 Bioprocess Engineering: Compulsory				
	General Engineering Science (English program): Specialisation F				
	General Engineering Science (English program, 7 semester): Spe				
	General Engineering Science (English program, 7 semester): Spe			mulaari	
General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Elective Compulsory				npulsory	
	Process Engineering: Core qualification: Compulsory				

Course L0095: Process and Plant Engineering I				
Тур	cture			
Hrs/wk	2			
CP	2			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28			
Course work	ine			
Lecturer	Prof. Georg Fieg			
Language	DE			
Cycle	SoSe			
Content	 Introduction Structure and operation of production plants Operational business process Technical process design Motivation and targets of process development Life cycle of production plants Engineering methods and tools Mass and energy balances Strategies of process synthesis Graphical representation of processes Multidimensional regression 			

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	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			
	a. Fieg, Heat and Mass Transfer 32(1996), S. 205-213			
	G. Fieg, Chem. Eng. Processing, Vol. 41/2(2001), S. 123-133			
	U.H. Felcht, Chemie eine reife Industrie oder weiterhin Innovationsmotor, Universitätsbuchhandlung Blazek und Bergamann, Frankfurt, 2000			
	J.P. van Gigch, Systems Design, Modeling and Metamodeling, Plenum Press, New York, 1991			
	T.F. Edgar, D.M. Himmelblau, L.S. Lasdon, Optimization of Chemical Processes, McGraw-Hill, 2001			
	G. Gruhn, Vorlesungsmanuskript "Prozess- und Anlagentechnik, TU Hamburg-Harburg			
	D. Hairston, Chemical Engineering, October 2001, S. 31-37			
	J.L.A. Koolen, Design of Simple and Robust Process Plants, Wiley-VCH, Weinheim, 2002			
	J. Krekel, G. Siekmann, ChemIngTech. 57(1985)Nr. 6, S. 511			
	K. Machej, G. Fieg, J. Wojcik, Inz. Chem. Proc., 2(1981), S.815-824			
	S. Meier, G. Kaibel, ChemIngTech. 62(1990)Nr. 13, S.169			
	J. Mittelstraß, ChemIngTech. 66(1994), S. 309			
	P. Li, M. Flender, K. Löwe, G. Wozny, G. Fieg, Fett/Lipid 100(1998), Nr. 12, S. 528-534			
	G. Kaibel, Dissertation, TU München, 1987			
	G. Kaibel, ChemIngTech. 61 (1989), Nr. 2, S. 104-112			
	G. Kaibel, Chem. Eng. Technol., 10(1987), Nr. 2, S. 92-98			
	H.J. Lang, Chem. Eng. 54(10),117, 1947			
	H.J. Lang, Chem. Eng. 55(6), 112, 1948			
	F. Lestak, C. Collins, Chemical Engineering, July 1997, S. 72-76			

Course L0096: Process and Plant Engineering I		
Тур	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 Tee	chnology and Solids Process Engineering				
Courses					
Title		Тур	Hrs/wk	CP	
Particle Technology I (L0434)		Lecture	2	3	
Particle Technology I (L0435)		Recitation Section (small)	1	1	
Particle Technology I (L0440)		Laboratory Course	2	2	
Module Responsible	Prof. Stefan Heinrich				
Admission Requirements	None				
Recommended Previous	keine				
Knowledge					
Educational Objectives	After taking part successfully, students have reached the foll	owing 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 dis 				
Skills	Students are able to				
	choose and design apparatuses and processes for s		s properties of the pi	roduct	
	 asses solids with respect to their behavior in solids p 	rocessing steps			
	 document their work scientifically. 				
Personal Competence					
Social Competence					
	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): Specialisa	ation Process Engineering: Compulsory			
Curricula	General Engineering Science (German program): Specialisa	ation Bioprocess Engineering: Compulsory			
	General Engineering Science (German program): Specialisation Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory				
	Bioprocess Engineering: Core qualification: Compulsory				
	Energy and Environmental Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory				
	General Engineering Science (English program): Specialisa	tion Energy and Enviromental Engineering: Co	on Energy and Enviromental Engineering: Compulsory		
	General Engineering Science (English program): Specialisa	tion Process Engineering: Compulsory			
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compul	sory		
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Com	pulsory		
	General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Eng	ineering: Compulso	ry	
	Process Engineering: Core qualification: Compulsory				



Course L0434: Particle Technology	1		
Тур	cture		
Hrs/wk			
CP	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Stefan Heinrich		
Language	DE		
Cycle	SoSe		
Content	 Description of particles and particle distributions Description of a separation process Description of a particle mixture Particle size reduction Agglomeration, particle size enlargement Storage and flow of bulk solids Basics of fluid/particle flows classifying processes Separation of particles from fluids Basic fluid mechanics of fluidized beds Pneumatic and hydraulic transport 		
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.		

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

Course L0440: Particle Technology	1		
Тур	Laboratory Course		
Hrs/wk			
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Stefan Heinrich		
Language	DE		
Cycle	SoSe		
Content	 Sieving Bulk properties Size reduction Mixing Gas cyclone Blaine-test, filtration Sedimentation 		
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.		

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Specialization Electrical Engineering

Module M0708: Electrical En	gineering III: Circuit Theory and Transients			
Courses				
Title		Тур	Hrs/wk	CP
Circuit Theory (L0566)		Lecture	3	4
Circuit Theory (L0567)		Recitation Section (small)	2	2
	Prof. Arne Jacob none			
-	Electrical Engineering I and II, Mathematics I and II			
Knowledge				
Kilowicage				
Educational Objectives A	After taking part successfully, students have reached the followin	a learning results		
Professional Competence		j loannig looano		
-	Students are able to explain the basic methods for calculating	electrical circuits. They know the Fou	rier series analysis of li	near networks driven by
	periodic signals. They know the methods for transient analysis			
	requency behaviour and the synthesis of passive two-terminal-c		, , , , , , , , , , , , , , , , , , ,	
Skills T	The students are able to calculate currents and voltages in linea	r networks by means of basic methods	s, also when driven by pe	eriodic signals. They are
а	able to calculate transients in electrical circuits in time and freque	ncy domain and are able to explain the	e respective transient bel	haviour. They are able to
а	analyse and to synthesize the frequency behaviour of passive tw	o-terminal-circuits.		
Personal Competence				
Social Competence	Students work on exercise tasks in small guided groups. They ar	e encouraged to present and discuss th	eir results within the gro	up.
Autor or 201		- the since exection evolution. Describil		
	The students are able to find out the required methods for solvin ectures continuously by means of short-time tests. This allows			
	knowledge to other courses like Electrical Engineering I and Mat			loy our link then guilled
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points 6	6			
Examination V	Written exam			
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): Specialisation	Electrical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): Sp			npulsory
	General Engineering Science (German program, 7 semester): Sp	ecialisation Electrical Engineering: Co	mpulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation		tropico: Compulsory	
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp	0 0,	1 3	nulsory
	General Engineering Science (English program, 7 semester): Sp General Engineering Science (English program, 7 semester): Sp			ipaisory
	Computational Science and Engineering: Specialisation Engineering			
	Mechatronics: Core qualification: Compulsory	5		
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory			
1		ctive Compulsory		

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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)
Literature	
	- 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



	I Electrical Engineering I: Time-Independen			
Courses				
Title		Тур	Hrs/wk	CP
Theoretical Electrical Engineering I: Time-		Lecture	3	5
Theoretical Electrical Engineering I: Time-		Recitation Section (small)	2	1
	Prof. Christian Schuster			
Admission Requirements	Elektrotechnik I, Elektrotechnik II, Mathematik I, Mathemati	k II, Mathematik III		
Recommended Previous	Basic principles of electrical engineering and advanced m	athematics		
Knowledge				
Educational Objectives	After taking part augesset illy at idents have reached the f			
Educational Objectives	After taking part successfully, students have reached the for	biowing learning results		
Professional Competence	Students can explain the fundamental formulae, relations	and matheda of the theory of time independent	at algotromognatic field	a Thou can avaliaata t
Knowledge	Students can explain the fundamental formulas, relations, principal behavior of electrostatic, magnetostatic, and co			
	complex electromagnetic fields by means of superpositio			
	independent electromagnetic fields and are able to explicate		are aware of applicate	
Skills	Students can apply Maxwell's Equations in integral nota	tion in order to solve highly symmetrical, tin	ne-independent, electro	magnetic field problem
	Furthermore, they are capable of applying a variety of me	thods that require solving Maxwell's Equatio	ns for more general pro	blems. The students c
	assess the principal effects of given time-independent sou			
	characterization of electrostatic, magnetostatic, and electrostatic	ical flow fields (capacitances, inductances, re	esistances, etc.) from giv	ven fields and dimension
	them for practical applications.			
Personal Competence				
Social Competence	Students are able to work together on subject related ta	asks in small groups. They are able to pres	ent their results effective	ely (e.g. during exerci
	sessions).			
Autonomy				
	reflect their knowledge by means of activities that accomp			
	the exam. Based on respective feedback, students are ex their knowledge obtained in this lecture and the content of			
	their knowledge obtained in this lecture and the content of	other rectores (e.g. Electrical Engineering I, E	near Aigebra, and Anar	ysis).
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
	Written exam			
Examination duration and scale	90-150 minutes			
Assignment for the Following	General Engineering Science (German program): Special			
Curricula	General Engineering Science (German program, 7 semes	ter): Specialisation Electrical Engineering: Co	mpulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Speciali			
	General Engineering Science (English program, 7 semest		npulsory	
	Technomathematics: Specialisation III. Engineering Scien	ce: Elective Compulsory		



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



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



Module M0748: Materials in	Electrical Engineering			
Courses				
Title		Тур	Hrs/wk	CP
Electrotechnical Experiments (L0714)		Lecture	1	1
Materials in Electrical Engineering (L0685)		Lecture	2	3
Materials in Electrical Engineering (Problem	m Solving Course) (L0687)	Recitation Section (small)	2	2
Module Responsible	Prof. Manfred Eich			
Admission Requirements	None			
Recommended Previous	Highschool level physics and mathematics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the for	ollowing learning results		
Professional Competence				
Knowledge	Students can explain the composition and the structural p	properties of materials used in electrical engin	neering. Students can e	explicate the relevance of
	mechanical, electrical, thermal, dielectric, magnetic and ch	nemical properties of materials in view of their a	applications in electrica	l engineering.
01.71		d and the second s		The second finders for the second
Skills	Students can identify appropriate descriptive models an		rive approximative sol	utions and judge factors
	influential on the performance of materials in electrical eng	lineering applications.		
Personal Competence				
Social Competence	Students can jointly solve subject related problems in gr	roups. They can present their results effective	ely within the framewor	k of the problem solving
	course.			
Autonomy	Students are capable to extract relevant information from	the provided references and to relate this int	ormation to the conten	t of the lecture. They can
	reflect their acquired level of expertise with the help of level	ecture accompanying measures such as exa	m typical exam questic	ons. Students are able to
	connect their knowledge with that acquired from other lect	ures.		
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): Speciali	sation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semes	ter): Specialisation Electrical Engineering: Cor	npulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Speciali	sation Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 semest	er): Specialisation Electrical Engineering: Con	npulsory	
	Computational Science and Engineering: Specialisation E	ngineering Sciences: Elective Compulsory		

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



Course L0685: Materials in Electrical Er Typ	
Hrs/wk 2	
CP 3	
	dependent Study Time 62, Study Time in Lecture 28 rof. Manfred Eich
Language DE	
0 0	oSe
	ne Hamiltonian approach to classical mechanics. Analysis of a simple oscillator.
	nalysis of vibrations in a one-dimensional lattice.
Ph	hononic bandgap
Intr	troduction to quantum mechanics
	/ave function, Schrödinger's equation, observables and measurements.
	uantum mechanical harmonic oscillator and spectral decomposition.
	ymmetries, conserved quantities, and the labeling of states.
	ngular momentum ne hydrogen atom
	laves in periodic potentials
	eciprocal lattice and reciprocal lattice vectors
	and gap
Ва	and diagrams
The	ne free electron gas and the density of states
	ermi-Dirac distribution
	ensity of charge carriers in semiconductors
	onductivity in semiconductors. Engineering conductivity through doping.
	ne P-N junction (diode) ght emitting diodes
	lectromagnetic waves interacting with materials
	eflection and refraction
Ph	hotonic band gaps
Ori	rigins of magnetization
	ysteresis in ferromagnetic materials
Ma	agnetic domains
Literature 1.A	Anikeeva, Beach, Holten-Andersen, Fink, Electronic, Optical and Magnetic Properties of Materials,
Ma	assachusetts Institute of Technology (MIT), 2013
2.+	Hagelstein et al., Introductory Applied Quantum and Statistical Mechanics, Wiley 2004
3.0	Griffiths, Introduction to Quantum Mechanics, Prentice Hall, 1994
4.5	Shankar, Principles of Quantum Mechanics, 2nd ed., Plenum Press, 1994
5.F	Fick, Einführung in die Grundlagen der Quantentheorie, Akad. Verlagsges., 1979
6.K	Kittel, Introduction to Solid State Physics, 8th ed., Wiley, 2004
7.A	Ashcroft, Mermin, Solid State Physics, Harcourt, 1976
8.F	Pierret, Semiconductor Fundamentals Vol. 1, Addison Wesley, 1988
9.5	Sze, Physics of Semiconductor Devices, Wiley, 1981
10.	0.Saleh, Teich, Fundamentals of Photonics, 2nd ed., 2007
11.	1 Joannopoulos, Johnson, Winn Meade, Photonic Crystals, 2nd ed., Princeton Universty Press, 2008
12.	2.Handley, Modern Magnetic Materials, Wiley, 2000
13.	3.Wikipedia, Wikimedia



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



Courses	
ïtle	Typ Hrs/wk CP
ignals and Systems (L0432)	Lecture 3 4
ignals and Systems (L0433)	Recitation Section (large) 1 2
Module Responsible	Prof. Gerhard Bauch
Admission Requirements	None
Recommended Previous	Mathematics 1-3
Knowledge	The modul is an introduction to the theory of signals and systems. Good knowledge in maths as covered by the moduls Mathematik 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	
	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse deterministic signals and systems.
	and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image domain which
0. "	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 as the impact of LTI systems on the signal properties in time and frequency domain.
Personal Competence	
Social Competence	The students can idintify calve specific problems
Autonomy	The students can jointly solve specific problems. The students are able to acquire relevant information from appropriate literature sources. They can control their level of knowledge during the level
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 Curricula	General Engineering Science (German program): Specialisation Electrical Engineering: Compulsory General Engineering Science (German program): Specialisation Computer Science: Compulsory
ourrout	General Engineering Science (German program): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Civil- and Enviromental Engeneering: Compulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compute
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering 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 Mechationics. Computering General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer
	Compulsory
	Computer Science: Core qualification: Compulsory
	Electrical Engineering: Core qualification: Compulsory
	General Engineering Science (English program): Specialisation Civil- and Enviromental Engeneering: Compulsory
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Computer Science: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation 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, Pocus Biomechanics. Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Pocus Energy Systems: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems: Computative General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compute
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Andra Osaterials in Engineering Science (English program); Specialisation (English program);
	Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Enginee
	Compulsory
	Computational Science and Engineering: Core qualification: Compulsory
	Mechatronics: Core qualification: Compulsory



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0432: Signals and Systems	
Typ Hrs/wk	2 S
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Gerhard Bauch
Language	DE/EN
Cycle	SoSe
Content	Basic classification and description of continuous-time and discrete-time signals and systems
	Concvolution
	Power and energy of signals
	Correlation functions of deterministic signals
	Linear time-invariant (LTI) systems
	Signal transformations:
	Fourier-Series
	• Fourier Transform
	Laplace Transform
	Discrete-time Fourier Transform
	 Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)
	• Z-Transform
	Analysis and design of LTI systems in time and frequency domain
	Basic filter types
	Sampling, sampling theorem
	Fundamentals of recursive and non-recursive discrete-time filters
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997
	J.R. Ohm, H.D. Lüke, Signalübertragung, Springer-Verlag 8. Auflage, 2002
	S. Haykin, B. van Veen: Signals and systems. Wiley.
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.

Course L0433: Signals and Systems	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 M0709: Electrical E	ngineering IV: Transmission Lines and	Research Seminar		
		nesearch 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 prop transmission lines in time and frequency domain. Th with coupled transmission lines. They can present an	ey can describe simple equivalent circuits of trans		-
Skills	Students can analyze and calculate the propagation of waves in simple circuits with transmission lines. They are able to analyze circuits in frequency domain and with the Smith chart. They can analyze equivalent circuits of transmission lines. They are able to solve problems including coupled transmission lines using the vectorial transmission line equations. They are able to give a talk to professionals.			
Personal Competence Social Competence	Students can analyze and solve problems in small electure and discuss it in small groups. They are able t			ry with experiments in th
Autonomy	The students can solve problems by their own and are able to acquire skills from the lecture and the literature. They are able to test their knowledge using computer animations. They can test their level of knowledge by answering short questions and tests during the lecture. They are able to relate thei acquired knowledge to other lectures (e.g. Electrical Engineering I-III and Mathematics I-III). They can familiarize themselves with a research topic and can prepare a presentation.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84	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				
Guncula	Electrical Engineering: Core qualification: Compulsor	, ,		
	General Engineering Science (English program): Spe			
	General Engineering Science (English program, 7 se		nulsory	
		, ,	ipuisory	
	Computational Science and Engineering: Specialisat			
	Technomathematics: Specialisation III. Engineering S			
	Technomathematics: Core qualification: Elective Corr	ipuisory		

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 T	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	



	ngineering Project Laboratory				
Courses					
Title		Тур	Hrs/wk	CP	
Electrical Engineering Project Laboratory (L0640)	Laboratory Course	5	6	
Module Responsible	Prof. Christian Becker				
Admission Requirements	None				
Recommended Previous	Electrical Engineering I, Electrical Engineering II				
Knowledge					
Educational Ohiosticas					
Educational Objectives	After taking part successfully, students have reached the	e following learning results			
Professional Competence			a since and illustrate second	ative valationahing. Th	
Knowledge	Students are able to give a summary of the technical d are capable of describing and communicating relevant				
	process of solving practical problems and present relate		echinical language. They	can explain the typic	
	process of solving practical problems and present relate				
Skills	The students can transfer their fundamental knowled	ae on electrical engineering to the process	of solving practical prob	lems. They identify a	
	overcome typical problems during the realization of pro				
	conceptual solutions for non-standardized problems.	, , , , , , , , , , , , , , , , , , , ,			
Personal Competence					
Social Competence	Students are able to cooperate in small, mixed-subject	t groups in order to independently derive soluti	ons to given problems in	the context of electric	
	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				
	develop alternative approaches to an electrical engineer	ring problem independently or in groups and di	scuss advantages as wel	l as drawbacks.	
Autonomy	Students are capable of independently solving electric	al engineering problems using provided literati	ure. They are able to fill g	aps in as well as exte	
	their knowledge using the literature and other sources provided by the supervisor. Furthermore, they can meaningfully extend given problems ar				
	pragmatically solve them by means of corresponding solutions and concepts.				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70				
Credit points Examination	6 Broinst				
Examination duration and scale	Project based on task + presentation				
Assignment for the Following	General Engineering Science (German program): Spec	indiraction Electrical Engineering: Compulsion			
Curricula	General Engineering Science (German program, 7 sem		mpulsory		
Guilloud	Electrical Engineering: Core qualification: Compulsory		mpaloory		
	General Engineering Science (English program): Speci	alisation Electrical Engineering: Compulsory			
	General Engineering Science (English program, 7 semi		mpulsory		
	Technomathematics: Specialisation III. Engineering Sci				
	Technomathematics: Core qualification: Elective Comp				
Course L0640: Electrical Engineerin	ng Project Laboratory				
Тур	Laboratory Course				
Hrs/wk	5				
CP	6				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70				
Lecturer	Prof. Christian Becker, Dozenten des SD E				
Language	PE .				

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.
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).



	es IV				
Courses		_			
Title		Тур	Hrs/wk	CP	
Differential Equations 2 (Partial Differentia		Lecture	2	1	
Differential Equations 2 (Partial Differentia		Recitation Section (small)	1	1	
Differential Equations 2 (Partial Differentia	Equations) (L1045)	Recitation Section (large)	1	1	
Complex Functions (L1038)		Lecture	2	1	
Complex Functions (L1041)		Recitation Section (small)	1	1	
Complex Functions (L1042)		Recitation Section (large)	1	1	
Module Responsible	Prof. Anusch Taraz				
Admission Requirements	none				
Recommended Previous	Mathematics 1 - III				
Knowledge					
Educational Objectives	After taking part successfully, students have reached th	ne following learning results			
-	, and any part of concerns, can only the office a				
Professional Competence					
Knowledge	 Students can name the basic concepts in Math 	ematics IV. They are able to explain them using appro	priate examples		
				th the help of every	
	_	een these concepts. They are capable of illustrating the	lese connections wi	In 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 th	
	by applying established methods.				
	Students are able to discover and verify further	logical connections between the concepts studied in	he course.		
	 For a given problem, the students can develop 	and execute a suitable approach, and are able to criti	cally evaluate the re	sults.	
	· · · · · · · · · · · · · · · · · · ·				
Personal Competence					
Social Competence					
	 Students are able to work together in teams. The 	ney are capable to use mathematics as a common lang	guage.		
	 In doing so, they can communicate new concernance 	epts according to the needs of their cooperating partn	ers. Moreover, they	can design examples	
	check and deepen the understanding of their peers.				
Autonomy	 Students are eapable of checking their under 	tanding of complex concepts on their own. They can	chooify opon quoot	ions prosisoly and kn	
	 Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in achieve them. 				
	where to get help in solving them.				
	Students have developed sufficient persistence to be able to work for longer periods in a goal-oriented ma				
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112	2			
WORKIDAU III HOUIS		2			
	6				
Credit points	-				
Credit points Examination	Written exam				
	Written exam	ations 2)			
Examination Examination duration and scale	Written exam 60 min (Complex Functions) + 60 min (Differential Equ	,			
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe	cialisation Electrical Engineering: Compulsory	ien Oemeriken v		
Examination Examination duration and scale	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program): Spe	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron			
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron		ering: Compulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program): Spe	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica		ering: Compulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program): Spe General Engineering Science (German program): Spe	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory	I Mechanical Engine	eering: Compulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program): Spe General Engineering Science (German program): Spe General Engineering Science (German program): Spe	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu	I Mechanical Engine		
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu	l Mechanical Engine Isory s Mechatronics: Cor	npulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program): Spe General Engineering Science (German program): Spe General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu	l Mechanical Engine Isory s Mechatronics: Cor	npulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program): Spe General Engineering Science (German program): Spe General Engineering Science (German program) 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 Compulsory	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu semester): Specialisation Mechanical Engineering,	I Mechanical Engine Isory s Mechatronics: Cor Focus Theoretical M	npulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu semester): Specialisation Mechanical Engineering, mester): Specialisation Naval Architecture: Compulsor	I Mechanical Engine Isory s Mechatronics: Cor Focus Theoretical M	npulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program): Spe General Engineering Science (German program): Spe General Engineering Science (German program) 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 Compulsory	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu semester): Specialisation Mechanical Engineering, mester): Specialisation Naval Architecture: Compulsor	I Mechanical Engine Isory s Mechatronics: Cor Focus Theoretical M	npulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu semester): Specialisation Mechanical Engineering, mester): Specialisation Naval Architecture: Compulsor memory: Specialisation Naval Architecture: Compulsor	I Mechanical Engine Isory s Mechatronics: Cor Focus Theoretical M	npulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 Compulsory General Engineering Science (German program, 7 ser Computer Science: Specialisation Computational Matt	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu semester): Specialisation Mechanical Engineering, mester): Specialisation Naval Architecture: Compulsor nematics: Elective Compulsory	I Mechanical Engine Isory s Mechatronics: Cor Focus Theoretical M	npulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 Compulsory General Engineering Science (German program, 7 ser Computer Science: Specialisation Computational Matt Electrical Engineering: Core qualification: Compulsory	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu semester): Specialisation Mechanical Engineering, mester): Specialisation Naval Architecture: Compulsor nematics: Elective Compulsory	I Mechanical Engine Isory s Mechatronics: Cor Focus Theoretical M	npulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program): Spe General Engineering Science (German program): Spe General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser Compulsory General Engineering Science (German program, 7 ser Computer Science: Specialisation Computational Matt Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Spec General Engineering Science (English program): Spec	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Maval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu semester): Specialisation Mechanical Engineering, mester): Specialisation Naval Architecture: Compulsor nematics: Elective Compulsory cialisation Electrical Engineering: Compulsory cialisation Naval Architecture: Compulsory	I Mechanical Engine Isory s Mechatronics: Cor Focus Theoretical M y	npulsory	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 Compulsory General Engineering Science (German program, 7 ser Computer Science: Specialisation Computational Matt Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Spec General Engineering Science (English program): Spec	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu semester): Specialisation Mechanical Engineering, mester): Specialisation Naval Architecture: Compulsor mematics: Elective Compulsory cialisation Electrical Engineering: Compulsory cialisation Naval Architecture: Compulsory cialisation Naval Architecture: Compulsory cialisation Mechanical Engineering, Focus Mechatron	I Mechanical Engine Isory s Mechatronics: Cor Focus Theoretical M y cs: Compulsory	npulsory Aechanical Engineeri	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 Compulsory General Engineering Science (German program, 7 Computer Science: Specialisation Computational Matt Electrical Engineering Science (English program): Spe General Engineering Science (English program): Spe	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu semester): Specialisation Mechanical Engineering, mester): Specialisation Naval Architecture: Compulsor mematics: Elective Compulsory cialisation Electrical Engineering: Compulsory cialisation Naval Architecture: Compulsory cialisation Naval Architecture: Compulsory cialisation Naval Architecture: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretical	I Mechanical Engine Isory s Mechatronics: Cor Focus Theoretical M y cs: Compulsory Mechanical Engine	npulsory Aechanical Engineeri	
Examination Examination duration and scale Assignment for the Following	Written exam 60 min (Complex Functions) + 60 min (Differential Equ General Engineering Science (German program): Spe General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 ser General Engineering Science (German program, 7 Compulsory General Engineering Science (German program, 7 ser Computer Science: Specialisation Computational Matt Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Spec General Engineering Science (English program): Spec	cialisation Electrical Engineering: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretica cialisation Naval Architecture: Compulsory mester): Specialisation Electrical Engineering: Compu mester): Specialisation Mechanical Engineering, Focu semester): Specialisation Mechanical Engineering, mester): Specialisation Naval Architecture: Compulsor mematics: Elective Compulsory cialisation Electrical Engineering: Compulsory cialisation Naval Architecture: Compulsory cialisation Naval Architecture: Compulsory cialisation Naval Architecture: Compulsory cialisation Mechanical Engineering, Focus Mechatron cialisation Mechanical Engineering, Focus Theoretical	I Mechanical Engine Isory s Mechatronics: Cor Focus Theoretical M y cs: Compulsory Mechanical Engine	npulsory Aechanical Engineeri	
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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)		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

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

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



Course L1041: Complex Functions	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course
Course L1042: Complex Functions	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1

Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Module M0675: Introduction	n to Communications and Random Processes	3		
Courses				
Title		Тур	Hrs/wk	CP
Introduction to Communications and Random Processes (L0442)		Lecture	3	4
Introduction to Communications and Random Processes (L0443) Recitation Section (large)			1	2
Module Responsible	Prof. Gerhard Bauch			
Admission Requirements	None			
Recommended Previous Knowledge	Mathematics 1-3			
Educational Objectives	After taking part successfully, students have reached the follow	ing learning 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 and evaluation criteria of information transmission and are able to design and evaluate a basic communications system.			
Skills	The students are able to design and evaluate a basic communications system. In particular, they can estimate the required resources in terms o bandwidth and power. They are able to assess essential evaluation parameters of a basic communications system such as bandwidth efficiency or bi 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 appropriate literature sources. They can control their level of knowledge during the lecture period by solving tutorial problems, software tools, clicker system.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisatio	on Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester):	Specialisation Electrical Engineering: Com	pulsory	
	Computer Science: Specialisation Computer and Software Eng	ineering: Elective Compulsory		
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation	n Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): S		pulsory	
	Computational Science and Engineering: Specialisation Engin	• • • •		
Technomathematics: Specialisation III. Engineering Science: Elective 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	Fundamentals of random processes
	Introduction to communications engineering
	Quadrature amplitude modulation
	Description of radio frequency transmission in the equivalent complex baseband
	 Transmission channels, channel models Analog digital conversion: Sampling, quantization, pulsecode modulation (PCM)
	Fundamentals of information theory, source coding, channel coding
	 Digital baseband transmission: Pulse shaping, eye diagramm, 1. and 2. Nyquist condition, matched filter, detection, error probability
	Fundamentals of digital modulation
Literature	K. Kammeyer: Nachrichtenübertragung, Teubner
	P.A. Höher: Grundlagen der digitalen Informationsübertragung, Teubner.
	M. Bossert: Einführung in die Nachrichtentechnik, Oldenbourg.
	J.G. Proakis, M. Salehi: Grundlagen der Kommunikationstechnik. Pearson Studium.
	J.G. Proakis, M. Salehi: Digital Communications. McGraw-Hill.
	S. Haykin: Communication Systems. Wiley
	J.G. Proakis, M. Salehi: Communication Systems Engineering. Prentice-Hall.
	J.G. Proakis, M. Salehi, G. Bauch, Contemporary Communication Systems. Cengage Learning.

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



Module M0568: Theoretical	Electrical Engineering II: Time-Dependent Fiel	ds		
Courses				
Title		Тур	Hrs/wk	CP
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, Theoretical Electrical	ectrical Engineering I		
Knowledge	Mathematics I, Mathematics II, Mathematics III, Mathematics IV			
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	Students are able to explain fundamental formulas, relations, assess the principal behavior and characteristics of quasistatic properties of complex electromagnetic fields by means of sup theory of time-dependent electromagnetic fields and are able to	onary and fully dynamic fields with regard erposition of solutions for simple fields.	d to respective sources	s. They can describe the
Skills	Students are able to apply a variety of procedures in order to solve the diffusion and the wave equation for general time-dependent field problems. They can assess the principal effects of given time-dependent sources of fields and analyze these quantitatively. They can deduce meaningful quantities for the characterization of fully dynamic fields (wave impedance, skin depth, Poynting-vector, radiation resistance, etc.) from given fields and interpret them with regard to practical applications.			
Personal Competence				
Social Competence	Students are able to work together on subject related tasks i sessions).	n small groups. They are able to presen	nt their results effective	ely (e.g. during exercise
Autonomy	Students are capable to gather necessary information from pro reflect their knowledge by means of activities that accompany th the exam. Based on respective feedback, students are expecte acquired knowledge and ongoing research at the Hamburg Uni	e lecture, such as short oral quizzes duri d to adjust their individual learning proce	ng the lectures and exe ss. They are able to dr	ercises that are related to aw connections betweer
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): Specialisation	n Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): S		pulsory	
	Electrical Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation	Electrical Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Sp	pecialisation Electrical Engineering: Com	pulsory	
	Technomathematics: Specialisation III. Engineering Science: Ele	ective Compulsory		
	Technomathematics: Core qualification: Elective Compulsory			



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)



Тур	Recitation Section (small)
Hrs/wk	
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)
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	- 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 M0783: Measureme	ents: Methods and Data Processing			
Courses				
Title		Тур	Hrs/wk	CP
EE Experimental Lab (L0781)		Laboratory Course	2	2
Measurements: Methods and Data Proces	ssing (L0779)	Lecture	2	3
Measurements: Methods and Data Proces	ssing (L0780)	Recitation Section (small)	1	1
Module Responsible	Prof. Alexander Schlaefer			
Admission Requirements	none			
Recommended Previous	principles of mathematics			
Knowledge	principles of electrical engineering			
Educational Objectives	After taking part successfully, students have reached the followi	ng learning results		
Professional Competence				
Knowledge	The students are able to explain the purpose of metrology and theory and errors, and explain the processing of stochastic sign			
Skills	The students are able to evaluate problems of metrology and to	apply methods for describing and proces	sing of measurements	
Personal Competence				
Social Competence	The students solve problems in small groups.			
Autonomy	The students can reflect their knowledge and discuss and evalu	ate their results.		
Meddeed in Herme	Jackson dark Obudu Time 110. Obudu Time in Lastice 70			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points Examination	b Written exam			
Examination Examination duration and scale	90 min			
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation		tive Compulson	
Gurricula	General Engineering Science (German program, 7 semester): S Computer Science: Specialisation Computer and Software Engi		ave compulsory	
	Electrical Engineering: Core qualification: Compulsory	meening. Liective Compuisory		
	General Engineering Science (English program): Specialisation	Electrical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): S			
	Computational Science and Engineering: Specialisation Engine		ive compusory	
	Computational Science and Engineering: Specialisation Engine Technomathematics: Specialisation III. Engineering Science: El	• • •		
		ecuve compulsory		
	Technomathematics: Core qualification: Elective Compulsory			

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

Course L0779: Measurements: Met	Course L0779: Measurements: Methods and Data Processing		
Тур	Lecture		
Hrs/wk	2		
CP	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Alexander Schlaefer		
Language	DE		
Cycle	WiSe		
Content	introduction, systems and errors in metrology, probability theory, measuring stochastic signals, describing measurements, acquisition of analog signals, applied metrology		
Litereture	Durach Lofa Vianda Maatabali, Calisaa 2010		
Literature	Puente León, Kiencke: Messtechnik, Springer 2012 Lerch: Elektrische Messtechnik, Springer 2012		
	Weitere Literatur wird in der Veranstaltung bekanntgegeben.		



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



Module M0760: Electronic I	Devices
Courses	
Title	Typ Hrs/wk CP
Electronic Devices (L0720)	Lecture 3 4
Electronic Devices (L0721)	Problem-based Learning 2 2
Module Responsible	Prof. Hoc Khiem Trieu
Admission Requirements	None
Recommended Previous	Atomic model and quantum theory, electrical currents in solid state materials, basics in solid-state physics
Knowledge	Successful participation of Physics for Engineers and Materials in Electrical Engineering or courses with equivalent contents
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	
	Students are able
	 to represent the basics of semiconductor physics,
	to explain the operating principle of important semiconductor devices,
	• to outline device characteristics and equivalent circuits as well as to explain their derivation and
	to discuss the limitation of device models.
Skills	
	Students are capable
	 to apply devices in basic circuits,
	to realize the physical context and to solve complex problems 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 discuss 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
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): 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
	Computational Science and Engineering: Specialisation Computer 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, 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 M0777: Semicondu	uctor Circuit Design			
Courses				
ïtle		Тур	Hrs/wk	CP
Semiconductor Circuit Design (L0763)		Lecture	3	4
Semiconductor Circuit Design (L0864)	1	Recitation Section (small)	1	2
Module Responsible	Prof. Wolfgang Krautschneider			
Admission Requirements	none			
Recommended Previous	Fundamentals of electrical engineering			
Knowledge	Basics of physics			
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge				
	Students are able to explain the functionality			
		sircuits and can discuss their advantages and disadvar		
	 Students have solid knowledge about memory Students are able to explain how analog circl 	y circuits and can explain their functionality and specif	lications.	
	 Students are able to explain now analog circl Students know the appropriate fields for the u 			
	• Olddenis know the appropriate rields for the b			
Skills				
	-	ifferent MOS devices and can define the parameters of	f electronic circuits.	
		rcuits and can design different types of logic circuits.		
	 Students can use MOS devices, operational a 	amplifiers and bipolar transistors for specific application	ns.	
Deve and Commetance				
Personal Competence				
Social Competence	Students are able work efficiently in heteroge	neous teams.		
	Students working together in small groups ca	n solve problems and answer professional questions.		
Autonomy		- La da -		
	 Students are able to assess their level of know 	wiedge.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture	56		
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following				
Curricula	General Engineering Science (German program): Sp	pecialisation Mechanical Engineering, Focus Mechatro	onics: Compulsory	
		emester): Specialisation Electrical Engineering: Comp	•	
		emester): Specialisation Mechanical Engineering, Foc	us Mechatronics: Comp	ulsory
	Computer Science: Specialisation Computer and So			
	Electrical Engineering: Core qualification: Compulso			
	General Engineering Science (English program): Sp			
		ecialisation Mechanical Engineering, Focus Mechatro		
		emester): Specialisation Electrical Engineering: Comp		Joon
		emester): Specialisation Mechanical Engineering, Foc	us iviecnatronics: Compl	usory
	Computational Science and Engineering: Specialisa			
	Mechanical Engineering: Specialisation Mechatronic Mechatronics: Core qualification: Compulsory	s. compulsory		
	Technomathematics: Core qualification: Elective Cor	noulsory		
	Technomathematics: Specialisation III. Engineering			
	roomonationatios. opecialisation ili. Englieening	Solonoo. Lieuwe Oompuladi y		



Course L0763: Semiconductor Circu	uit Design
	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 perfomance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S
	 HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 3519004674 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944 U. Tietze und Ch. Schenk, E. Gamm, Halbleiterschaltungstechnik, Springer Verlag, 14. Auflage, 2012, ISBN 3540428496 H. Göbel, Einführung in die Halbleiter-Schaltungstechnik, Berlin, Heidelberg Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208867 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 URL: http://www.ciando.com/book/index.cfm/bok_id/319955 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



Courses				
Title		Тур	Hrs/wk	CP
ntroduction to Management (L0880)		Lecture	3	3
Project Entrepreneurship (L0882)		Problem-based Learning	2	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fo	Illowing learning results		
Professional Competence Knowledge				
Skills	 Marketing and Innovation, and also to Investment and Con explain the differences between Economics and Marifield of Management explain the most important aspects of and goals in I describe and explain basic business functions as ressource management, information management, explain the relevance of planning and decision m some basic methods from mathematical Finance state basics from accounting and costing and select Students are able to analyse business units with rest Entrepreneurship project in a team. In particular, they are a analyse Management goals and structure them app analyse organisational and staff structures of comp apply methods for decision making under multiple of analyse and apply basic methods of marketing select and apply basic methods from mathematical apply basic methods from accounting, costing and 	anagement and the sub-disciplines in Managem Management and name the most important aspe production, procurement and sourcing, supply innovation management and marketing naking in Business, esp. in situations under mu ted controlling methods. spect to different criteria (organization, object able to propriately anies objectives, under uncertainty and under risk Business information systems finance to predefined problems	ects of entrepmeurial p chain management, o ultiple objectives and	projects organization and hum uncertainty, and expla
Personal Competence Social Competence Autonomy	 Students are able to work successfully in a team of students to apply their knowledge from the lecture to an entration of the communicate appropriately and to cooperate respectfully with their fellow students. Students are able to 		t on the project	
	 work in a team and to organize the team themselve to write a report on their project. 	S		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
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 90 Minuten General Engineering Science (German program): Specialis			
Credit points Examination Examination duration and scale	6 Written exam 90 Minuten General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis	isation Computer Science: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis	isation Computer Science: Compulsory isation Process Engineering: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program): Speciali: General Engineering Science (German program): Speciali: General Engineering Science (German program): Speciali:	sation Computer Science: Compulsory sation Process Engineering: Compulsory sation Bioprocess Engineering: Compulsory	omulsory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program): Speciali:	sation Computer Science: Compulsory sation Process Engineering: Compulsory sation Bioprocess Engineering: Compulsory sation Energy and Enviromental Engineering: C	1 3	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program): Speciali:	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: C isation Civil- and Enviromental Engeneering: Co	1 3	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program): Speciali:	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory	1 3	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program): Speciali:	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: C isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory	1 3	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program): Speciali:	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory	mpulsory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program): Speciali:	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Comp	mpulsory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program): Speciali:	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: C isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Compu- ter): Specialisation Process Engineering: Compu-	mpulsory pulsory ulsory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory tery: Specialisation Electrical Engineering: Compu- tery: Specialisation Process Engineering: Compu- tery: Specialisation Biomedical Engineering: Compu-	mpulsory pulsory ulsory mpulsory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory tery: Specialisation Electrical Engineering: Compu- tery: Specialisation Biomedical Engineering: Compu- tery: Specialisation Biomedical Engineering: Compu- tery: Specialisation Naval Architecture: Compulsory	mpulsory pulsory ulsory mpulsory ory	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Compu- tery: Specialisation Process Engineering: Compu- tery: Specialisation Biomedical Engineering: Compu- tery: Specialisation Naval Architecture: Compulsory tery: Specialisation Naval Architecture: Compulsory	mpulsory ulsory ulsory mpulsory ory ory	
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Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program, Speciali: General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Compu- ter): Specialisation Process Engineering: Compulsor ter): Specialisation Biomedical Engineering: Compulse ter): Specialisation Naval Architecture: Compulse ter): Specialisation Computer Science: Compulse ter): Specialisation Bioprocess Engineering: Corr ter): Specialisation Bioprocess Engineering: Corr ter): Specialisation Civil Engineering: Compulso	mpulsory ulsory mpulsory ory ory ory mpulsory ry	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory tery: Specialisation Electrical Engineering: Compu- tery: Specialisation Biomedical Engineering: Compulsory tery: Specialisation Biomedical Engineering: Compulsory tery: Specialisation Naval Architecture: Compulsor tery: Specialisation Bioprocess Engineering: Compulsor tery: Specialisation Bioprocess Engineering: Compulso tery: Specialisation Civil Engineering: Compulso tery: Specialisation Energy and Enviromental En	mpulsory ulsory ulsory mpulsory ory ory mpulsory ry gineering: Compulsor	
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory tery: Specialisation Electrical Engineering: Compu- tery: Specialisation Process Engineering: Compulsory tery: Specialisation Biomedical Engineering: Compulsory tery: Specialisation Naval Architecture: Compulsory tery: Specialisation Biomedical Engineering: Compulsory tery: Specialisation Bioprocess Engineering: Compulso tery: Specialisation Civil Engineering: Compulso tery: Specialisation Energy and Enviromental En- tery: Specialisation Mechanical Engineering, Foo- tery: Specialisation Mechanical Engineering, Foo- tery: Specialisation Mechanical Engineering, Foo- tery: Specialisation Mechanical Engineering, Foo-	mpulsory ulsory mpulsory ory ory mpulsory ry gineering: Compulsor cus Mechatronics: Con cus Biomechanics: Con cus Aircraft Systems Er	npulsory mpulsory ngineering: Compulso
Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 90 Minuten General Engineering Science (German program): Speciali: General Engineering Science (German program, 7 semest General Engineering	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Compu- ter): Specialisation Process Engineering: Compulsory ter): Specialisation Naval Architecture: Compulsory ter): Specialisation Biomedical Engineering: Compu- ter): Specialisation Naval Architecture: Compulso ter): Specialisation Bioprocess Engineering: Compulso ter): Specialisation Computer Science: Compulso ter): Specialisation Energy and Enviromental En- ter): Specialisation Mechanical Engineering, Foo- ter): Specialisation Mechanical Engineering, Foo- ter): Specialisation Mechanical Engineering, Foo- ter): Specialisation Mechanical Engineering, Foo- ter): Specialisation Mechanical Engineering, Foo-	mpulsory ulsory mpulsory ory ory gineering: Compulsory ry gus Mechatronics: Con cus Biomechanics: Con cus Aircraft Systems Er g, Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Scienc



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



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

Course L0882: Project 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.

2



Specialization Computer Science

Module M0561: Discrete Al	gebraic Structures			
Courses				
Title		Тур	Hrs/wk	CP
Discrete Algebraic Structures (L0164)		Lecture	2	3
Discrete Algebraic Structures (L0165)		Recitation Section (small)	2	3
Module Responsible	Prof. Karl-Heinz Zimmermann			
Admission Requirements	None.			
Recommended Previous	Mathematics from High School.			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	The students know the important basics of discrete algebraic s	tructures including elementary combinate	orial structures, mono	ids, groups, rings, fields,
	finite fields, and vector spaces. They also know specific structure	s like sub sum-, and quotient structures a	and homomorphisms.	
Skills	Students are able to formalize and analyze basic discrete algebraic structures.			
Personal Competence				
Social Competence	Students are able to solve specific problems alone or in a group	and to present the results accordingly.		
Autonomy	Students are able to acquire new knowledge from specific standa	ard books and to associate the aquired kn	owledge to other class	Ses
, leteneniy				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation	Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): Sp	ecialisation Computer Science: Compuls	sory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation	Computer Science: Compulsory		
	General Engineering Science (English program, 7 semester): Sp	ecialisation Computer Science: Compuls	ory	
	Computational Science and Engineering: Core qualification: Cor	npulsory		
	Technomathematics: Specialisation I. Mathematics: Elective Con	pulsory		

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
Objectoriented Programming, Algorithms a		Lecture	4	4
Objectoriented Programming, Algorithms a		Recitation Section (small)	1	2
	Prof. Rolf-Rainer Grigat			
Admission Requirements	None			
Recommended Previous Knowledge	Lecture Prozedurale Programmierung or equivale	nt proficiency in imperative programming		
	Mandatory prerequisite for this lecture is proficiency in imperative programming (C, Pascal, Fortran or similar). You should be familiar with simple of types (integer, double, char), arrays, if-then-else, for, while, procedure calls or function calls, pointers, and you should have used all those in your of programs and therefore should be proficient with editor, compiler, linker and debugger. In this lecture we will immediately start with the introduction objects and we will not repeat the basics mentioned above. This remark is especially important for AIW, GES, LUM because those prerequisites are not part of the curriculum. They are prerequisites for the stat those curricula in general. The programs ET, CI and IIW include those prerequisites in the first semester in the lecture Prozedurale Programmierung.			
Educational Objectives				
Professional Competence				
Knowledge	Students can explain the essentials of software	design and the design of a class architecture with re	eference to existing c	lass libraries and desi
	patterns.			
	Students can describe fundamental data structure	s of discrete mathematics and assess the complexity of	important algorithms f	or sorting and searchin
Skills	 Students are able to Design software using given design patterns and applying class hierarchies and polymorphism Carry out software development and tests using version management systems and Google Test Sort and search for data efficiently Assess the complexity of algorithms. 			
Personal Competence	Students can work in teams and communicate in fo			
Social Competence	Gueens can work in teams and communicate in it	Jumo.		
Autonomy	Students are able to solve programming tasks such as LZW data compression using SVN Repository and Google Test independently and over a perio of two to three weeks.			
Workload in Hours	Independent Study Time 110, Study Time in Lectu	re 70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	60 Minutes, Content of Lecture, exercises and mat	terial in StudIP		
Assignment for the Following	General Engineering Science (German program):			
Curricula		7 semester): Specialisation Computer Science: Compul	sory	
	Computer Science: Core qualification: Compulsor			
	Electrical Engineering: Core qualification: Comput	sory		
	General Engineering Science (English program):	Specialisation Computer Science: Compulsory		
	General Engineering Science (English program, 7	semester): Specialisation Computer Science: Computer	sory	
	Computational Science and Engineering: Core qu			
	Logistics and Mobility: Specialisation Engineering			
	Technomathematics: Core qualification: Compulse	ory		



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

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



Module M0624: Logic, Auto	omata and Formal Languages					
Courses						
Title		Тур	Hrs/wk	CP		
Logic, Automata Theory and Formal Lang	uages (L0332)	Lecture	2	4		
Logic, Automata Theory and Formal Lang	uages (L0507)	Recitation Section (small)	2	2		
Module Responsible	Prof. Tobias Knopp					
Admission Requirements	None					
Recommended Previous	Participating students should be able to					
Knowledge	- specify algorithms for simple data structures (such as, e.g., arrays) to solve computational problems					
	- apply propositional logic and predicate logic for specifyir	g and understanding mathematical proofs				
	- apply the knowledge and skills taught in the module Disc	crete Algebraic Structures				
Educational Objectives	After taking part successfully, students have reached the for	ollowing learning results				
Professional Competence						
Skills	Students can explain syntax, semantics, and decision problems of propositional logic, and they are able to give algorithms for solving decision problems. Students can show correspondences to Boolean algebra. Students can describe which application problems are hard to represent with propositional logic, and therefore, the students can motivate predicate logic, and define syntax, semantics, and decision problems for this representation formalism. Students can explain unification and resolution for solving the predicate logic SAT decision problem. Students can also describe syntax, semantics, and decision problems for various kinds of temporal logic, and identify their application areas. The participants of the course can define various kinds of finite automata and can identify relationships to logic and formal grammars. The spectrum that students can explain ranges from deterministic and nondeterministic finite automata and pushdown automata to Turing machines. Students can name those formalism for which nondeterminism is more expressive than determinism. They are also able to demonstrate which decision problems require which expressivity, and, in addition, students can transform decision problems w.r.t. one formalism into decision problems w.r.t. other formalisms. They understand that some formalisms such as logic, automata, or grammars.					
Personal Competence						
Social Competence						
Autonomy						
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56					
Credit points	6					
Examination	Written exam					
Examination duration and scale	90 min					
Assignment for the Following	General Engineering Science (German program): Special	isation Computer Science: Compulsory				
Curricula	General Engineering Science (German program, 7 semes		ompulsory			
	Computer Science: Core qualification: Compulsory					
	General Engineering Science (English program): Speciali	sation Computer Science: Compulsory				
	General Engineering Science (English program, 7 semest	er): Specialisation Computer Science: Elective Co	ompulsory			
	Computational Science and Engineering: Core qualification	on: Compulsory				
	Technomathematics: Specialisation II. Informatics: Elective	e Compulsory				



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Hrs/wk	2			
CP	4			
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28			
Lecturer	rof. Tobias Knopp			
Language	N state type			
Cycle	oSe			
Content				
Content	1. Propositional logic, Boolean algebra, propositional resolution, SAT-2KNF			
	2. Predicate logic, unification, predicate logic resolution			
	3. Temporal Logics (LTL, CTL)			
	4. Deterministic finite automata, definition and construction			
	5. Regular languages, closure properties, word problem, string matching			
	6. Nondeterministic automata:			
	Rabin-Scott transformation of nondeterministic into deterministic automata			
	7. Epsilon automata, minimization of automata,			
	elimination of e-edges, uniqueness of the minimal automaton (modulo renaming of states)			
	8. Myhill-Nerode Theorem:			
	Correctness of the minimization procedure, equivalence classes of strings induced by automata			
	9. Pumping Lemma for regular languages:			
	provision of a tool which, in some cases, can be used to show that a finite automaton principally cannot be expressive enough to solve a wo			
	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-fr			
	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 log			
	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				
Literature	1. Logik für Informatiker Uwe Schöning, Spektrum, 5. Aufl.			
	2. Logik für Informatiker Martin Kreuzer, Stefan Kühling, Pearson Studium, 2006			
	3. Grundkurs Theoretische Informatik, Gottfried Vossen, Kurt-Ulrich Witt, Vieweg-Verlag, 2010.			
	4. Principles of Model Checking, Christel Baier, Joost-Pieter Katoen, The MIT Press, 2007			

Course L0507: Logic, Automata Theory and Formal Languages				
Тур	ecitation 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			



courses	
itle	Typ Hrs/wk CP
ignals and Systems (L0432)	Lecture 3 4
ignals and Systems (L0433)	Recitation Section (large) 1 2
Module Responsible	Prof. Gerhard Bauch
Admission Requirements	None
Recommended Previous	Mathematics 1-3
Knowledge	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 experimented to a second structure covers and the second structure covers and stru
	Further experience with spectral transformations (Fourier series, Fourier transform, Laplace transform) is useful but not required.
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The students are able to classify and describe signals and linear time-invariant (LTI) systems using methods of signal and system theory. They are
	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse deterministic si
	and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image domain whic
	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 as
Baraanal Compatance	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 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 Process 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 Scie
	Compulsory
	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 gualification: Compulsory
	Electrical Engineering: Core qualification: Compulsory
	General Engineering Science (English program): Specialisation Civil- and Enviromental Engeneering: Compulsory
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Computer Science: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compul
	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 Scie
	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
	Mechatronics: Core qualification: Compulsory



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Osures 1.0400, Cinnels and Custome					
Course L0432: Signals and Systems	s Lecture				
Hrs/wk	3				
CP	4				
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42				
Lecturer	Prof. Gerhard Bauch				
Language	/EN				
Cycle	Se				
Content	Basic classification and description of continuous-time and discrete-time signals and systems				
	Concvolution				
	Power and energy of signals				
	Correlation functions of deterministic signals				
	Linear time-invariant (LTI) systems				
	Signal transformations:				
	• Fourier-Series				
	• Fourier Transform				
	Laplace Transform				
	Discrete-time Fourier Transform				
	Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT)				
	• Z-Transform				
	Analysis and design of LTI systems in time and frequency domain				
	Basic filter types				
	Sampling, sampling theorem				
	Fundamentals of recursive and non-recursive discrete-time filters				
Literature	T. Frey , M. Bossert , Signal- und Systemtheorie, B.G. Teubner Verlag 2004				
	K. Kammeyer, K. Kroschel, Digitale Signalverarbeitung, Teubner Verlag.				
	B. Girod ,R. Rabensteiner , A. Stenger , Einführung in die Systemtheorie, B.G. Teubner, Stuttgart, 1997				
	• J.R. Ohm, H.D. Lüke, Signalübertragung, Springer-Verlag 8. Auflage, 2002				
	S. Haykin, B. van Veen: Signals and systems. Wiley.				
	Oppenheim, A.S. Willsky: Signals and Systems. Pearson.				
	Oppenheim, R. W. Schafer: Discrete-time signal processing. Pearson.				

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



courses				
itle	Тур		Hrs/wk	CP
troduction to Management (L0880)	Lecture Broblem bo	used Learning	3 2	3 3
roject Entrepreneurship (L0882)		sed Learning	2	3
Module Responsible				
Admission Requirements				
Recommended Previous Knowledge	-			
Educational Objectives				
Professional Competence				
Knowledge			ement, from Plann	ning and Organisatior
Skille	 explain the differences between Economics and Management and the sub-disc field of Management explain the most important aspects of and goals in Management and name the describe and explain basic business functions as production, procurement an ressource management, information management, innovation management and explain the relevance of planning and decision making in Business, esp. in 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 (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 analyse and apply basic methods of marketing select and apply basic methods for mathematical finance to predefined proble apply basic methods from accounting, costing and controlling to predefined proble 	most important aspects o nd sourcing, supply chai d marketing situations under multiple (organization, objectives y and under risk us	of entreprneurial p in management, c e objectives and	projects organization and hun uncertainty, and expl
Social Competence Autonomy	 work successfully in a team of students to apply their knowledge from the lecture to an entrepreneurship project and write to communicate appropriately and to cooperate respectfully with their fellow students. y Students are able to work in a team and to organize the team themselves 	ite a coherent report on t	the project	
	to write a report on their project.			
Workload in Hours	s Independent Study Time 110, Study Time in Lecture 70			
	s 6			
Credit points	n Written exam			
Credit points Examination				
Credit points Examination Examination duration and scale	e 90 Minuten	r: Compulsory		
Credit points Examination	 90 Minuten g General Engineering Science (German program): Specialisation Electrical Engineering 			
Credit points Examination Examination duration and scale Assignment for the Following	 90 Minuten g General Engineering Science (German program): Specialisation Electrical Engineering 	ompulsory		
Credit points Examination Examination duration and scale Assignment for the Following	 90 Minuten g General Engineering Science (German program): Specialisation Electrical Engineering a General Engineering Science (German program): Specialisation Computer Science: Computer Science 	ompulsory Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	 90 Minuten g General Engineering Science (German program): Specialisation Electrical Engineering a General Engineering Science (German program): Specialisation Computer Science: C General Engineering Science (German program): Specialisation Process Engineering: 	ompulsory Compulsory ng: Compulsory	ulsory	
Credit points Examination Examination duration and scale Assignment for the Following	 90 Minuten g General Engineering Science (German program): Specialisation Electrical Engineering a General Engineering Science (German program): Specialisation Computer Science: C General Engineering Science (German program): Specialisation Process Engineering: General Engineering Science (German program): Specialisation Bioprocess Engineering: 	ompulsory Compulsory ing: Compulsory ental Engineering: Compu		
Credit points Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation Electrical Engineering General Engineering Science (German program): Specialisation Computer Science: C General Engineering Science (German program): Specialisation Process Engineering: General Engineering Science (German program): Specialisation Bioprocess Engineering General Engineering Science (German program): Specialisation Energy and Environeering	ompulsory : Compulsory ing: Compulsory ental Engineering: Compu- tal Engeneering: Comput		
Credit points Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation Electrical Engineering General Engineering Science (German program): Specialisation Computer Science: C General Engineering Science (German program): Specialisation Process Engineering: General Engineering Science (German program): Specialisation Bioprocess Engineering General Engineering Science (German program): Specialisation Energy and Enviromee General Engineering Science (German program): Specialisation Energy and Enviromee General Engineering Science (German program): Specialisation Energy and Enviromee General Engineering Science (German program): Specialisation Energy and Enviromeet General Engineering Science (German program): Specialisation Civil- and Enviroment	ompulsory : Compulsory ing: Compulsory ental Engineering: Compu- tal Engeneering: Compul ing: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	90 Minuten General Engineering Science (German program): Specialisation Electrical Engineering General Engineering Science (German program): Specialisation Computer Science: C General Engineering Science (German program): Specialisation Process Engineering: General Engineering Science (German program): Specialisation Bioprocess Engineering General Engineering Science (German program): Specialisation Energy and Envirome General Engineering Science (German program): Specialisation Energy and Envirome General Engineering Science (German program): Specialisation Energy and Envirome General Engineering Science (German program): Specialisation Civil- and Enviroment General Engineering Science (German program): Specialisation Mechanical Engineering	ompulsory Compulsory ing: Compulsory intal Engineering: Compu- tal Engeneering: Compul- ing: Compulsory ing: Compulsory		
Credit points Examination Examination duration and scale Assignment for the Following	90 Minuten 90 Minuten General Engineering Science (German program): Specialisation Electrical Engineering General Engineering Science (German program): Specialisation Computer Science: C General Engineering Science (German program): Specialisation Bioprocess Engineering: General Engineering Science (German program): Specialisation Bioprocess Engineering: General Engineering Science (German program): Specialisation Energy and Enviromer General Engineering Science (German program): Specialisation Energy and Enviromer General Engineering Science (German program): Specialisation Civil- and Enviroment General Engineering Science (German program): Specialisation Mechanical Engineeri General Engineering Science (German program): Specialisation Biomedical Engineeri General Engineering Science (German program): Specialisation Naval Architecture: C General Engineering Science (German program): Specialisation Naval Architecture: C	ompulsory Compulsory ing: Compulsory intal Engineering: Compu- tal Engeneering: Compul- ing: Compulsory ing: Compulsory ompulsory Engineering: Compulsor	Isory	
Credit points Examination Examination duration and scale Assignment for the Following	90 Minuten 90 Minuten g General Engineering Science (German program): Specialisation Electrical Engineering General Engineering Science (German program): Specialisation Computer Science: C General Engineering Science (German program): Specialisation Bioprocess Engineering: General Engineering Science (German program): Specialisation Energy and Enviromer General Engineering Science (German program): Specialisation Energy and Enviromer General Engineering Science (German program): Specialisation Civil- and Enviromer General Engineering Science (German program): Specialisation Mechanical Engineeri General Engineering Science (German program): Specialisation Mechanical Engineeri General Engineering Science (German program): Specialisation Biomedical Engineeri General Engineering Science (German program): Specialisation Naval Architecture: C General Engineering Science (German program, 7 semester): Specialisation Electrical General Engineering Science (German program, 7 semester): Specialisation Process E	ompulsory Compulsory and Compulsory antal Engineering: Compul ing: Compulsory ing: Compulsory ompulsory Engineering: Compulsory Engineering: Compulsory	lsory ry y	
Credit points Examination Examination duration and scale Assignment for the Following	90 Minuten 90 Minuten g General Engineering Science (German program): Specialisation Electrical Engineering General Engineering Science (German program): Specialisation Computer Science: C General Engineering Science (German program): Specialisation Bioprocess Engineering: General Engineering Science (German program): Specialisation Bioprocess Engineering General Engineering Science (German program): Specialisation Energy and Envirome General Engineering Science (German program): Specialisation Energy and Envirome General Engineering Science (German program): Specialisation Civil- and Enviroment General Engineering Science (German program): Specialisation Mechanical Engineeri General Engineering Science (German program): Specialisation Biomedical Engineeri General Engineering Science (German program): Specialisation Naval Architecture: C General Engineering Science (German program, 7 semester): Specialisation Electrical General Engineering Science (German program, 7 semester): Specialisation Process E General Engineering Science (German program, 7 semester): Specialisation Biomedice	ompulsory Compulsory and Compulsory antal Engineering: Compul- ing: Compulsory ing: Compulsory ompulsory Engineering: Compulsory Engineering: Compulsory al Engineering: Compulsory	lsory ry y	
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Compulsory
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Civil- and Environmental Engineering: Core qualification: Compulsory
Bioprocess Engineering: Core qualification: Compulsory
Computer Science: Core qualification: Compulsory
Electrical Engineering: Core qualification: Compulsory
Energy and Environmental Engineering: Core qualification: Compulsory
General Engineering Science (English program): Specialisation Civil- and Enviromental Engeneering: Compulsory
General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory
General Engineering Science (English program): Specialisation Computer Science: Compulsory
General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
General Engineering Science (English program): Specialisation Naval Architecture: Compulsory
General Engineering Science (English program): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Compulsory
General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Computational Science and Engineering: Core qualification: Compulsory
Logistics and Mobility: Core qualification: Compulsory
Mechanical Engineering: Core qualification: Compulsory
Mechatronics: Core qualification: Compulsory
Naval Architecture: Core qualification: Compulsory
Technomathematics: Core qualification: Compulsory
 Process Engineering: Core qualification: Compulsory



rse L0880: Introduction to Mana				
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. Wol			
	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.			

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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Module M0852: Graph The	ory and Optimization			
Courses				
Title		Тур	Hrs/wk	CP
Graph Theory and Optimization (L1046)		Lecture	2	3
Graph Theory and Optimization (L1047)		Recitation Section (small)	2	3
Module Responsible	Prof. Anusch Taraz			
Admission Requirements	none			
Recommended Previous	Discusts Alexies's Objections			
Knowledge	Discrete Algebraic Structures			
	Mathematics I			
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge				
	Students can name the basic concepts in Graph Theory			
	Students can discuss logical connections between thes	e concepts. They are capable of illustrating	these connections w	ith the help of examples
	They know proof strategies and can reproduce them.			
Skills				
	Students can model problems in Graph Theory and Op	timization with the help of the concepts stud	lied in this course. M	preover, they are capab
	of solving them by applying established methods.		- H	
	Students are able to discover and verify further logical c			lt-
	For a given problem, the students can develop and exercise	cute a suitable approach, and are able to cr	itically evaluate the re	esuits.
Personal Competence Social Competence	 Students are able to work together in teams. They are c In doing so, they can communicate new concepts according check and deepen the understanding of their peers. 			/ can design examples
Autonomy		- (Para a second a standard second data a
	 Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in solving them. 			
	 Students have developed sufficient persistence to be ab 	ble to work for longer periods in a goal-orier	nted manner on hard	problems.
				r
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	on Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semester):	Specialisation Computer Science: Compuls	ory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation	n Computer Science: Compulsory		
	General Engineering Science (English program, 7 semester): S	Specialisation Computer Science: Compulse	ory	
	Computational Science and Engineering: Core qualification: Co	ompulsory		
	Logistics and Mobility: Specialisation Engineering Science: Ele	ective Compulsory		
	Technomathematics: Specialisation I. Mathematics: Elective Co	ompulsory		



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

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



Module M0662: Numerical I	Athematics I			
Courses				
litle		Тур	Hrs/wk	СР
Numerical Mathematics I (L0417)		Lecture	2	3
Numerical Mathematics I (L0418)		Recitation Section (small)	2	3
Module Responsible	Prof. Sabine Le Borne			
Admission Requirements	None			
Recommended Previous Knowledge	Mathematik I + II for Engineering Students (german or basic MATLAB knowledge	english) or Analysis & Linear Algebra I + II f	or Technomathematicia	ins
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 	nods,		finding problems and
Skills	 Students are able to implement, apply and compare numerical methods using MATLAB, justify the convergence behaviour of numerical methods with respect to the problem and solution algorithm, 			
	 select and execute a suitable solution approach for a select and execute a suitable solution approach for a select and execute a suitable solution. 	given problem.		
Personal Competence				
Social Competence	Students are able to			
Autonomy	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	tical excercises are better solved individual		
Models adds the second	Indexed at 2014 Taxa 404 Or at Taxa in Lord as 50			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisat			
Curricula	General Engineering Science (German program): Specialisat General Engineering Science (German program): Specialisat			
	General Engineering Science (German program): Specialisal		is in Engineering Scien	ces. Compulsory
	General Engineering Science (German program, 7 semester)		con	
	General Engineering Science (German program, 7 semester) General Engineering Science (German program, 7 semester)			
	Compulsory	ter). Opecialisation mechanical Engineeri	ng, rocus materiais in	Engineering ocient
	General Engineering Science (German program, 7 semester)	· Specialisation Biomedical Engineering: Co	ampulsory	
	General Engineering Science (German program, 7 semester)			mpulsory
	Bioprocess Engineering: Specialisation A - General Bioproce			1
	Computer Science: Specialisation Computational Mathematic	• • • • •		
	Electrical Engineering: Core qualification: Elective Compulso			
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program): Specialisati			
	General Engineering Science (English program): Specialisati		hanics: Compulsory	
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Material	s in Engineering Science	ces: Compulsory
	General Engineering Science (English program, 7 semester):	Specialisation Computer Science: Computer	sory	
	General Engineering Science (English program, 7 semes			Engineering Science
	Compulsory			
	General Engineering Science (English program, 7 semester)	Specialisation Biomedical Engineering: Co	mpulsory	
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering, Fo	cus Biomechanics: Con	npulsory
	Computational Science and Engineering: Core qualification:	Compulsory		



Course L0417: Numerical Mathema	tics I		
Тур	Lecture		
Hrs/wk	2		
CP	3		
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Lecturer	Prof. Sabine Le Borne		
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
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



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

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

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



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



Module M0791: Computer	Architecture			
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 th	a avaluation of the module's evenination	according to the followi	
	The succession completion of the labs will be nonored during th		according to the lonowi	ng rules.
	1. Upon a passed module examination, the student is g	ranted a bonus on the examination's ma	arks 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 u	p to 4,0 is not possible.		
Educational Objectives	After taking part successfully, students have reached the follow	ng learning results		
Professional Competence				
Knowledge	This module presents advanced concepts from the discipline	of computer architecture. In the beginning	a, a broad overview ov	er various programming
Ũ	models is given, both for general-purpose computers and for			
	micro-architecture of processors are covered. Here, the focus	particularly lies on the so-called pipelining	g and the methods use	ed for the acceleration of
	instruction execution used in this context. The students get to know concepts for dynamic scheduling, branch prediction, superscalar execution machine instructions and for memory hierarchies.			superscalar execution of
Skills	The students are able to describe the organization of processor	s. They know the different architectural pri	nciples and programmi	na models. The students
	examine various structures of pipelined processor architecture			•
	performance or energy efficiency. They evaluate different str			
	distinguish between instruction- and data-level parallelism.			
Personal Competence				
Social Competence	Students are able to solve similar problems alone or in a group	and to present the results accordingly.		
p				
Autonomy	Students are able to acquire new knowledge from specific litera	ture 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): Specialisatio	n Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semester): S	Specialisation Computer Science: Elective	Compulsory	
	Computer Science: Specialisation Computer and Software Eng	ineering: Elective Compulsory		
	General Engineering Science (English program): Specialisation	n Computer Science: Compulsory		
	General Engineering Science (English program, 7 semester): S	pecialisation Computer Science: Elective	Compulsory	
	Computational Science and Engineering: Specialisation Comp	uter Science: Elective Compulsory		

Course L0793: Computer Architecture		
Тур	ecture	
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	ure
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



Module M0834: Computern	etworks and Internet Security			
Courses				
Title		Тур	Hrs/wk	CP
Computer Networks and Internet Security	(L1098)	Lecture	3	5
Computer Networks and Internet Security	(L1099)	Recitation Section (small)	1	1
Module Responsible	Prof. Andreas Timm-Giel			
Admission Requirements	None			
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ring learning results		
Professional Competence				
Knowledge	Students are able to explain important and common Internet p	rotocols in detail and classify them, in orde	er to be able to analyse	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 profes	sional knowledge and can independently	learn and understand it	•
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): Specialisation	on Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semester):	Specialisation Computer Science: Elective	Compulsory	
	Computer Science: Core qualification: Compulsory			
	Electrical Engineering: Core qualification: Elective Compulsory	/		
	General Engineering Science (English program): Specialisatio	n Computer Science: Compulsory		
	General Engineering Science (English program, 7 semester): S	Specialisation Computer Science: Elective	Compulsory	
	Computational Science and Engineering: Core qualification: C	ompulsory		
	Technomathematics: Specialisation II. Informatics: Elective Con	mpulsory		
	Technomathematics: Specialisation II. Informatics: Elective Con	mpulsory		

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



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



Module M0731: Functional	Programming			
	riogramming			
Courses				
Title		Тур	Hrs/wk	CP
Functional Programming (L0624)		Lecture	2	2
Functional Programming (L0625)		Recitation Section (large)	2	2
Functional Programming (L0626)		Recitation Section (small)	2	2
Module Responsible	Prof. Sibylle Schupp			
Admission Requirements	None			
Recommended Previous	Discrete mathematics at high-school level			
Knowledge				
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	Students apply the principles, constructs, and simp	ple design techniques of functional programming.	They demonstrate the	ir ability to read Hask
	programs and to explain Haskell syntax as well as I	Haskell's read-eval-print loop. They interpret warnir	ngs and find errors in p	programs. They apply the
	fundamental data structures, data types, and type constructors. They employ strategies for unit tests of functions and simple proof techniques for p			oof techniques for part
	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 we They assess different language constructs, make conscious selections both at specification and implementations level, and justify their choice. Th analyze given programs and rewrite them in a controlled way. They design and implement unit tests and can assess the quality of their tests. They argue for the correctness of their program.			
Personal Competence				
Social Competence	Students practice peer programming with varying p	peers. They explain problems and solutions to their	peer. They defend the	air programs orally. Th
Social Competence	communicate in English.		peer. mey delend the	en programs orany. Th
Autonomy	In programming labs, students learn under supervis	sion (a.k.a. "Betreutes Programmieren") the mechar	nics of programming. In	n exercises, they develo
	solutions individually and independently, and receive	e feedback.		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 8-	4		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Sp	pecialisation Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 se	emester): Specialisation Computer Science: Elective	e Compulsory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Spe	ecialisation Computer Science: Compulsory		
	General Engineering Science (English program, 7 se	amastar); Engliantian Computer Science; Elective	Compulson	
1	contrat Englisteering colonice (English program, 7 ee	emester). Specialisation Computer Science. Elective	Compulsory	

Course L0624: Functional Program	ming		
Тур	Lecture		
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 Programming Idioms of Functional Programming Haskell Syntax and Semantics 		
Literature	Graham Hutton, Programming in Haskell, Cambridge University Press 2007.		



Course L0625: Functional Programm	ning
Тур	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Sibylle Schupp
Language	EN
Cycle	WiSe
Content	 Functions, Currying, Recursive Functions, Polymorphic Functions, Higher-Order Functions Conditional Expressions, Guarded Expressions, Pattern Matching, Lambda Expressions Types (simple, composite), Type Classes, Recursive Types, Algebraic Data Type Type Constructors: Tuples, Lists, Trees, Associative Lists (Dictionaries, Maps) Modules Interactive Programming Lazy Evaluation, Call-by-Value, Strictness Design Recipes Testing (axiom-based, invariant-based, against reference implementation) Reasoning about Programming Idioms of Functional Programming Haskell Syntax and Semantics
Literature	Graham Hutton, Programming in Haskell, Cambridge University Press 2007.
	1

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 M0727: Stochastics	•			
Courses				
Title		Тур	Hrs/wk	CP
Stochastics (L0777) Stochastics (L0778)		Lecture	2	4
	Def Made L'adage	Recitation Section (small)	2	2
	Prof. Marko Lindner			
	none			
Recommended Previous	Calculus			
Knowledge	Discrete algebraic structures (combinatorics)			
	Propositional logic			
Educational Objectives	After taking part successfully, students have reached the for	llowing learning results		
Professional Competence				
Knowledge	Students can explain the main definitions of probability	y, and they can give basic definitions of me	odeling elements (ra	ndom variables, events,
	dependence, independence assumptions) used in discrete and continuous settings (joint and marginal distributions, density functions). Students c			functions). Students can
	describe characteristic notions such as expected values	s, variance, standard deviation, and moments.	Students can define	decision problems and
	explain algorithms for solving these problems (based or	the chain rule or Bayesian networks). Algorit	thms, or estimators as	they are caller, can be
	analyzed in terms of notions such as bias of an estimator	, etc. Student can describe the main ideas of s	tochastic processes a	nd explain algorithms for
	solving decision and computation problem for stochastic p	rocesses. Students can also explain basic statis	tical detection and est	imation techniques.
Skills	Students can apply algorithms for solving decision prob	lems, and they can justify whether approxima	ation techniques are	good enough in various
	application contexts, i.e., students can derive estimators an	nd judge whether 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): Speciali	sation Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semes	er): Specialisation Computer Science: Compuls	sory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Speciali	sation Computer Science: Compulsory		
	General Engineering Science (English program, 7 semest	er): Specialisation Computer Science: Compuls	ory	
	Computational Science and Engineering: Core qualification	n: Compulsory		
	Logistics and Mobility: Specialisation Engineering Science	Elective Compulsory		



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

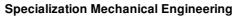
Course L0778: Stochastics		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Francisco Javier Hoecker-Escuti	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0971: Operating S	Systems			
Courses				
Title		Тур	Hrs/wk	CP
Operating Systems (L1153)		Lecture	2	3
Operating Systems (L1154)		Recitation Section (small)	2	3
Module Responsible	Prof. Volker Turau			
Admission Requirements	None			
Recommended Previous	 Object-oriented programming, algorithms, and data s 	structures		
Knowledge	 Procedural programming 			
	 Experience in using tools related to operating system 	ns such as editors, linkers, compilers		
	Experience in using tools related to operating systems such as editors, inkers, compilers Experience in using C-libraries			
Educational Objectives	After taking part successfully, students have reached the foll	owing 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 the			process states and their
	transitions, and paraphrase the architectural variants of operating systems. They give examples of existing operating systems and explain			
	architectures. The participants of the course write concurrent programs using threads, conditional variables and semaphores. Students can describ			tudents can describe the
	variants of realizing a file system. Students explain at least three different scheduling algorithms.			
Skills	Students are able to use the POSIX libraries for concurre	ent programming in a correct and efficient wa	av. They are able to	iudge the efficiency of a
	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 scheduling algorithm for a given scheduling task in a given environment.			,g,
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): Specialisa	ation Computer Science: Compulsory		
Curricula	General Engineering Science (German program, 7 semeste	r): Specialisation Computer Science: Elective	Compulsory	
	Computer Science: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisa	tion Computer Science: Compulsory		
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Elective C	Compulsory	
	Computational Science and Engineering: Specialisation Co	mputer Science: Elective Compulsory		
	Technomathematics: Specialisation II. Informatics: Elective 0	Compulsory		

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

ourse 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



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 specialisation (product development and manufacturing, material science, aircrafts, energy Engineering, mechatronics, medical engineering, theoretical mechanical engineering). They have in particular the necessary methodological knowledge and its application to engineering problems, taking into account technical specifications and economic and social parameters.
 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 specialisation.

Module M0598: Mechanical Engineering: Design

Courses				
Title		Тур	Hrs/wk	CP
Embodiment Design and 3D-CAD (L0268)		Lecture	2	1
Mechanical Design Project I (L0695)		Practical Course	3	2
Mechanical Design Project II (L0592)		Practical Course	3	2
Team Project Design Methodology (L0267		Problem-based Learning	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	Fundamentals of Mechanical Engineering Design			
Knowledge	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the foll	owing learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	 explain design guidelines for machinery parts e.g. co 	onsidering load situation, materials and manu	facturing requirements,	
	describe basics of 3D CAD,			
	 explain basics methods of engineering designing. 			
Skills	After passing the module, students are able to:			
	 independently create sketches, technical drawings a 			
	 design components based on design guidelines auto 	onomously,		
	 dimension (calculate) used components, 			
	 use methods to design and solve engineering design 	n tasks systamtically and solution-oriented,		
	 apply creativity techniques in teams. 			
Personal Competence				
Social Competence	After passing the module, students are able to:			
	 develop and evaluate solutions in groups including r 	making and documenting decisions,		
	 moderate the use of scientific methods, 			
	 present and discuss solutions and technical drawing 	is within groups,		
	 reflect the own results in the work groups of the course 	se.		
Autonomy	Students are able			
Autonomy	Sudents are able			
	 to estimate their level of knowledge using activating 	methods within the lectures (e.g. with clicker	s),	
	 To solve engineering design tasks systematically. 			
Workload in Hours	Independent Study Time 40, Study Time in Lecture 140			
Credit points	6			
	Written exam			
Examination duration and scale	180			
Assignment for the Following	General Engineering Science (German program): Specialisa		Compulsory	
Curricula	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste			
	General Engineering Science (German program, 7 semeste		ngineering: Compulsor	у
	Energy and Environmental Engineering: Core qualification:			
	General Engineering Science (English program): Specialisa		Compulsory	
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program, 7 semester			
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory			
	General Engineering Science (English program, 7 semester			,
				1



Naval Architecture: Core qualification: Compulsory

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

Course L0695: Mechanical Design F	Project I		
Тур	Practical Course		
Hrs/wk			
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	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 Desigr	Methodology		
Тур	Problem-based Learning		
Hrs/wk			
CP	1		
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28		
Lecturer	Prof. Dieter Krause		
Language	DE		
Cycle	SoSe		
Content	 Introduction to engineering designing methodology Team Project Design Methodology Creating requirement lists Problem formulation Creating functional structures Finding solutions Evaluation of the found concepts Documentation of the taken methodological steps and the concepts using presentation slides 		
Literature	 Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage. Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage. Sowie weitere Bücher zu speziellen Themen 		



	tals of Materials Science			
Courses				
Fitle		Тур	Hrs/wk	CP
Fundamentals of Materials Science I (L10	85)	Lecture	2	2
Fundamentals of Materials Science II (Ad	vanced Ceramic Materials, Polymers and Composites) (L0506)	Lecture	2	2
Physical and Chemical Basics of Material	s Science (L1095)	Lecture	2	2
Module Responsible	Prof. Jörg Weißmüller			
Admission Requirements	None			
Recommended Previous	Highschool-level physics, chemistry und mathematics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	The students have acquired a fundamental knowledge on Fundamental knowledge here means specifically the issues o mechanical properties. The students know about the key asp characterizing specific properties. They are able to trace materi	f atomic structure, microstructure, ph pects of characterization methods for	ase diagrams, phase transfor materials and can identify r	rmations, corrosion elevant approaches
Skills	The students are able to trace materials phenomena back to the mechanical properties such as strength, ductility, and stiffness, solidification, precipitation, or melting. The students can explain can account for the impact of microstructure on the material's be	chemical properties such as corrosi in the relation between processing c	on resistance, and to phase t	transformations sucl
Personal Competence				
	-			
Social Competence				
Social Competence Autonomy	- - Independent Study Time 06, Study Time in Lecture 94			
Social Competence Autonomy Workload in Hours	- - Independent Study Time 96, Study Time in Lecture 84			
Social Competence Autonomy Workload in Hours Credit points	6			
Social Competence Autonomy Workload in Hours Credit points Examination	6 Written exam			
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	6 Written exam 180 min			
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisatio			
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale	6 Written exam 180 min General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio	n Mechanical Engineering: Compuls	ory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio	n Mechanical Engineering: Compuls n Biomedical Engineering: Compuls	ory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio	n Mechanical Engineering: Compuls n Biomedical Engineering: Compulso n Naval Architecture: Compulsory	ory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): S	n Mechanical Engineering: Compuls n Biomedical Engineering: Compuls n Naval Architecture: Compulsory Specialisation Mechanical Engineerir	ory ory ng: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S	n Mechanical Engineering: Compuls n Biomedical Engineering: Compulso n Naval Architecture: Compulsory Specialisation Mechanical Engineerin Specialisation Biomedical Engineerin	ory ory ng: Compulsory ıg: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): 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 Mechanical Engineering: Compuls n Biomedical Engineering: Compulson n Naval Architecture: Compulsory Specialisation Mechanical Engineerin Specialisation Biomedical Engineerin Specialisation Naval Architecture: Co	ory ory ng: Compulsory ng: Compulsory mpulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): 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 General Engineering Science (German program, 7 semester): S	n Mechanical Engineering: Compuls n Biomedical Engineering: Compulso n Naval Architecture: Compulsory Specialisation Mechanical Engineerin Specialisation Biomedical Engineerin Specialisation Naval Architecture: Co Specialisation Energy and Enviromer	ory ory ng: Compulsory ng: Compulsory mpulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): 5 General Engineering Science (German program, 7 semester): 5 Energy and Environmental Engineering: Core qualification: Co	n Mechanical Engineering: Compuls n Biomedical Engineering: Compulso n Naval Architecture: Compulsory Specialisation Mechanical Engineerin Specialisation Biomedical Engineerin Specialisation Naval Architecture: Co Specialisation Energy and Enviromer mpulsory	ory ory ng: Compulsory ng: Compulsory mpulsory ntal Engineering: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): 5 General Engineering Science (German program, 7 semester): 5 Energy and Environmental Engineering: Core qualification: Co General Engineering Science (English program): Specialisatio	n Mechanical Engineering: Compuls n Biomedical Engineering: Compulsor n Naval Architecture: Compulsory Specialisation Mechanical Engineerin Specialisation Biomedical Engineerin Specialisation Naval Architecture: Co Specialisation Energy and Enviromer mpulsory n Energy and Enviromental Engineer	ory ory ng: Compulsory ng: Compulsory mpulsory ntal Engineering: Compulsory ing: Compulsory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): 5 General Engineering Science (German program, 7 semester): 5 Energy and Environmental Engineering: Core qualification: Co General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio	n Mechanical Engineering: Compuls n Biomedical Engineering: Compulsor n Naval Architecture: Compulsory Specialisation Mechanical Engineerin Specialisation Biomedical Engineerin Specialisation Naval Architecture: Co Specialisation Energy and Enviromer mpulsory n Energy and Enviromental Engineer n Mechanical Engineering: Compulso	ory ory ng: Compulsory ng: Compulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory	
Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): 5 General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	n Mechanical Engineering: Compuls n Biomedical Engineering: Compulsor N Naval Architecture: Compulsory Specialisation Mechanical Engineerin Specialisation Biomedical Engineerin Specialisation Naval Architecture: Co Specialisation Energy and Enviromer mpulsory n Energy and Enviromental Engineer n Mechanical Engineering: Compulso n Biomedical Engineering: Compulso	ory ory ng: Compulsory ng: Compulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory	
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Social Competence Autonomy Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	6 Written exam 180 min General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): S General Engineering Science (German program, 7 semester): S Energy and Environmental Engineering: Core qualification: Co General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S Cogistics and Mobility: Specialisation Engineering Science: Ele	n Mechanical Engineering: Compuls n Biomedical Engineering: Compulsor N Naval Architecture: Compulsory Specialisation Mechanical Engineerin Specialisation Naval Architecture: Co Specialisation Energy and Enviromer mpulsory n Energy and Enviromental Engineer n Mechanical Engineering: Compulsory n Naval Architecture: Compulsory specialisation Mechanical Engineerin specialisation Biomedical Engineering: pecialisation Mechanical Engineering specialisation Naval Architecture: Corpulsory specialisation Naval Architecture: Compulsory specialisation Mechanical Engineering specialisation Naval Architecture: Corpulsory specialisation Biomedical Engineering specialisation Naval Architecture: Corpusition	ory ory ng: Compulsory mpulsory ntal Engineering: Compulsory ing: Compulsory ory ory g: Compulsory g: Compulsory g: Compulsory mpulsory	

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



Course L0506: Fundamentals of Materials Science II (Advanced Ceramic Materials, Polymers and Composites)

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

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



Module 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, o	lifferentials			
Knowledge	Basics of electrical engineering and mechanical engineering				
	basics of electrical engineering and mechanical engineering				
Educational Objectives	After taking part successfully, students have reached the following	earning results			
Professional Competence					
Knowledge	Students can to draw and explain the basic principles of electric an	id magnetic fields.			
	They can describe the function of the standard types of electric	machines and present the correspon	ding aquations and a	horostariatia aunyoa. Er	
	typically used drives they can explain the major parameters of the		•		
	typically used drives they can explain the major parameters of the	shergy enclericy of the whole system in	on the power grid to t	e dilven engine.	
Skills	Students arw able to calculate two-dimensional electric and magn	etic fields in particular ferromagnetic ci	cuits with air gap. For	this they apply the usu	
	methods of the design auf electric machines.				
	They can calulate the operational performance of electric machine	s from their given characteristic data an	d selected quantities a	nd characteristic curve	
	They apply the usual equivalent circuits and graphical methods.				
Personal Competence					
Social Competence	none				
Autonomy	Students are able independently to calculate electric and magn	atic fields for applications. They are a	ble to analyse indep	endently the operation	
	performance of electric machines from the charactersitic data and t				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70				
Credit points	6				
Examination	Written exam				
Examination duration and scale	120 Minuten				
Assignment for the Following	General Engineering Science (German program): Specialisation E	nergy and Enviromental Engineering: C	compulsory		
Curricula	General Engineering Science (German program): Specialisation M				
	General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering: Ele	ective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory				
	Energy and Environmental Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Me				
	General Engineering Science (English program, 7 semester): Spec			r	
	General Engineering Science (English program, 7 semester): Spec		ctive Compulsory		
	Computational Science and Engineering: Specialisation Engineeri				
	Logistics and Mobility: Specialisation Engineering Science: Electiv	e Compulsory			
	Mechanical Engineering: Core qualification: Elective Compulsory				
	Mechatronics: Core qualification: Compulsory				



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

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



Module M0865: Fundament	als of Production and Quality Ma	nagement			
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Courses					
Title		Тур	Hrs/wk	CP	
Production Process Organization (L0925)		Lecture	2	3	
Quality Management (L0926)		Lecture	2	3	
Module Responsible	Prof. Hermann Lödding				
Admission Requirements	none				
Recommended Previous	None				
Knowledge					
Educational Objectives	After taking part successfully, students have r	eached the following learning results			
Professional Competence					
Knowledge	Students are able to explain the contents of the lecture of the module.				
Skills	Students are able to apply the methods and models in the module to industrial problems.				
Personal Competence					
Social Competence					
Autonomy					
Workload in Hours	Independent Study Time 124, Study Time in I	Lecture 56			
Credit points	6				
Examination	Written exam				
Examination duration and scale	180 Minuten				
Assignment for the Following	General Engineering Science (German progr	ram): Specialisation Mechanical Engineering: Elective C	ompulsory		
Curricula	General Engineering Science (German progr	ram, 7 semester): Specialisation Mechanical Engineering	g: Elective Compulsory		
	General Engineering Science (English progra	am): Specialisation Mechanical Engineering: Elective Co	ompulsory		
	General Engineering Science (English progra	am, 7 semester): Specialisation Mechanical Engineering	g: Elective Compulsory		
	Logistics and Mobility: Specialisation Engine	ering Science: Elective Compulsory			
	Mechanical Engineering: Core qualification: I	Elective Compulsory			

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



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



Courses	
ïtle	Typ Hrs/wk CP
signals and Systems (L0432)	Lecture 3 4
ignals and Systems (L0433)	Recitation Section (large) 1 2
Module Responsible	Prof. Gerhard Bauch
Admission Requirements	None
Recommended Previous	Mathematics 1-3
Knowledge	
	The modul is an introduction to the theory of signals and systems. Good knowledge in maths as covered by the moduls Mathematik 1-3 is expect
	Further experience with spectral transformations (Fourier series, Fourier transform, Laplace transform) is useful but not required.
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	,
	The students are able to classify and describe signals and linear time-invariant (LTI) systems using methods of signal and system theory. They are a
Kilowiedge	to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They can describe and analyse deterministic sign
	and systems mathematically in both time and image domain. In particular, they understand the effects in time domain and image domain which
	caused by the transition of a continuous-time signal to a discrete-time signal.
Skille	The students are able to describe and analyse deterministic signals and linear time-invariant systems using methods of signal and system theory. The
Skills	can analyse and design basic systems regarding important properties such as magnitude and phase response, stability, linearity etc They can ass
	the impact of LTI systems on the signal properties in time and frequency domain.
Baraanal Compotence	ure impact of citris ystems on the signal properties in time and nequency domain.
Personal Competence	
Social Competence	The students can jointly solve specific problems.
Autonomy	The students are able to acquire relevant information from appropriate literature sources. They can control their level of knowledge during the lect
	period by solving tutorial problems, software tools, clicker system.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Examination	Written exam
Examination duration and scale	90 min
Assignment for the Following	General Engineering Science (German program): Specialisation Electrical Engineering: Compulsory
Curricula	General Engineering Science (German program): Specialisation Computer Science: Compulsory
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program): Specialisation Civil- and Enviromental Engeneering: Compulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (German program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Computer
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
	Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering
	Compulsory
	Computer Science: Core qualification: Compulsory
	Electrical Engineering: Core qualification: Compulsory
	General Engineering Science (English program): Specialisation Civil- and Enviromental Engeneering: Compulsory
	General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Computer Science: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulso
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Science
	Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineer
	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			
CP				
Workload in Hours	lependent Study Time 78, Study Time in Lecture 42			
Lecturer	of. 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 M0680: Fluid Dyna	mics				
, , , , , , , , , , , , , , , , ,					
Courses					
Title		Тур	Hrs/wk	CP	
Fluid Mechanics (L0454)		Lecture	3	4	
Fluid Mechanics (L0455)		Recitation Section (large)	2	2	
Module Responsible	Prof. Thomas Rung				
Admission Requirements	none				
Recommended Previous	Sound knowledge of engineering mathematics, engineering	ng mechanics and thermodynamics.			
Knowledge					
Educational Objectives	After taking part successfully, students have reached the for	bllowing learning results			
Professional Competence					
Knowledge	Students will have the required sound knowledge to expla	ain the general principles of fluid engineering a	nd physics of fluids. S	Students can scientifica	
	outline the rationale of flow physics using mathematical r	nodels and are familiar with methods for the pe	rformance analysis a	nd the prediciton of fl	
	engineering devices.				
CI-ill-			al aveta ma Tha la shu		
Skills	11 5 6 61 1			re enables the studen	
	carry out all necessary theoretical calculations for the fluid	aynamic design of engineering devices on a sci	enunc level.		
Personal Competence					
Social Competence	The students are able to discuss problems and jointly deve	elop solution strategies.			
Autonomy	The students are able to develop solution strategies for co	mplex problems self-consistent and crtically ana	lvse 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): Speciali	sation Mechanical Engineering: Compulsory			
Curricula	General Engineering Science (German program): Special	sation Biomedical Engineering: Compulsory			
	General Engineering Science (German program): Specialisation Naval Architecture: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (German program, 7 semes	ter): Specialisation Naval Architecture: Compulse	ory		
	General Engineering Science (English program): Specialis	sation Mechanical Engineering: Compulsory			
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Naval Architecture: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering: Compulsory				
	General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (English program, 7 semest	er): Specialisation Naval Architecture: Compulse	ory		
	Computational Science and Engineering: Specialisation E	ingineering Sciences: Elective Compulsory			
	Mechanical Engineering: Core qualification: Compulsory				
	Naval Architecture: Core qualification: Compulsory				

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



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

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



Module M0934: Advanced	Materials			
Courses				
Title		Тур	Hrs/wk	CP
Advanced Materials Characterization (L10	187)	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	d the following learning results		
Professional Competence				
Knowledge	The students will be able to explain the properties of advanced materials along with their applications in technology, in particular metallic, ceramic			
	polymeric, semiconductor, modern composite mater	ials (biomaterials) and nanomaterials.		
Skills				
		scale. The students will also gain an overview on m	odern materials scienc	e, which enables them t
	select optimum materials combinations depending of	on the technical applications.		
Personal Competence				
Social Competence	The students are able to present solutions to specia	lists and to develop ideas further.		
Autonomy	The students are able to			
	 assess their own strengths and weaknesses 			
	 define tasks independently. 			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 8	84		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): S	pecialisation Mechanical Engineering: Elective Com	pulsory	
Curricula	General Engineering Science (German program, 7 s	semester): Specialisation Mechanical Engineering: E	lective Compulsory	
	General Engineering Science (English program): Sp	pecialisation Mechanical Engineering: Elective Comp	oulsory	
	General Engineering Science (English program, 7 s	emester): Specialisation Mechanical Engineering: El	ective Compulsory	
	Mechanical Engineering: Core qualification: Elective	e Compulsory		

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



Course L1091: Advanced Materials	Design	
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	of. Bodo Fiedler, Prof. Stefan Müller, Prof. Patrick Huber, Prof. Gerold Schneider, Prof. Jörg Weißmüller	
Language	DE/EN	
Cycle	joSe	
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	Course L1092: Advanced Materials Design	
Тур	Recitation Section (large)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Bodo Fiedler, Prof. Stefan Müller, Prof. Patrick Huber, Prof. Gerold Schneider, Prof. Jörg Weißmüller	
Language	DE/EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Module M0960: Mechanics	IV (Kinetics II, Oscillations, Analytical Mecha	nics, Multibody Systems)		
Courses				
litle		Тур	Hrs/wk	CP
lechanics IV (Kinetics II, Oscillations, An	alytical Mechanics, Multibody Systems) (L1137)	Lecture	3	3
Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) (L1138)		Recitation Section (small)	2	2
lechanics IV (Kinetics II, Oscillations, An	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 foll	owing learning results		
Professional Competence				
Knowledge	The students can			
	describe the axiomatic procedure used in mechanica	al 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 a 	nd 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	overcome difficulties.		
Autonomy	Students are capable of determining their own strengths and	d weaknesses and to organize their time and lea	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): Specialis	ation Mechanical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialis	ation Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialis	ation Naval Architecture: Compulsory		
	General Engineering Science (German program, 7 semeste	r): Specialisation Mechanical Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semeste	r): Specialisation Biomedical Engineering: Corr	npulsory	
	General Engineering Science (German program, 7 semeste	r): Specialisation Naval Architecture: Compulso	ory	
	General Engineering Science (English program): Specialisa	tion Mechanical Engineering: Compulsory		
	General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisa	tion 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	ry	
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Naval Architecture: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science			
	Technomathematics: Core qualification: Elective Compulsor			
	Theoretical Mechanical Engineering: Technical Complement	tary Course Core Studies: Elective Compulsory	ý	

Course L1137: Mechanics IV (Kineti	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) Recitation Section (small) Recitation Section (small) Insymbol Recitation Section (small) Workload in Hours Independent Study Time 32, Study Time in Lecture 28 Workload in Hours Lecturer Prof. Robert Selfried Lecturet So Se Content Se Interlocking course Content Second (large) Recitation Section (large) Intersonk Independent Study Time 16, Study Time in Lecture 14 Lecturet Porf. Robert Selfried Lecturet De So Se Content <t< th=""><th></th><th></th></t<>		
Hrs/wk 2 CP 2 Workload in Hours Independent Study Time 32, Study Time in Lecture 28 Lecturer Prof. Robert Selfried Language DE Cycle SoSe Content See interlocking course Literature See interlocking course Course L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Course L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Kourse L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Kourse L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Kourse L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Kourse L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Kourse L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Kourse L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Kourse L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Kourse L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Literature Prof. Robert Selfviel Literature Prof. Robe	Course L1138: Mechanics IV (Kinet	ics II, Oscillations, Analytical Mechanics, Multibody Systems)
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 (Kinetting course) Recitation Section (large) Mark 1 Workload in Hours Independent Study Time in Lecture 14 Workload in Hours Independent Study Time in Lecture 14 DE E Course Language DE Course Language DE Course Longuage DE Securse Longuage DE Course Longuage DE Course Language DE Course SoSe	Тур	Recitation Section (small)
Workload in Hours Independent Study Time 32, Study Time in Lecture 28 Lecture Prof. Robert Seifried Language DE Cycle SoSe Content See interlocking course Editories See interlocking course Course L1139: Mechanics IV (Kinet-Ein Coking course Recitation Section (large) Recitation Section (large) I Workload in Hours Independent Study Time 16, Study Time in Lecture 14 Poil. Robert Seifried DE Editations Exture Prof. Robert Seifried Bechanics IV Subgrammed Study Time 16, Study Time in Lecture 14 Destination Section (large) Bechanics IV Subgrammed Study Time 16, Study Time in Lecture 14 Destination Section (large) Subgrammed Study Time 16, Study Time in Lecture 14 Destination Section (large) Bechanics IV Subgrammed Study Time 16, Study Time in Lecture 14 Destination Section (large) Subgrammed Study Time 16, St	Hrs/wk	2
Lecturer Prof. Robert Seifried Language DE Cycle SoSe Content See interlocking course Literature See interlocking course Sourse L1139: Mechanics IV (Kinetting, Analytical Mechanics, Multibody Systems) Course L1139: Mechanics IV (Kinetting) Recitation Section (large) Hrs/wk 1 Operation Section (large) Workload in Hours Independent Study Time 16, Study Time in Lecture 14 Lecturer Prof. Robert Seifried Lecturer DE Course Sose Course Sose Sose Sose	CP	2
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Cycle SoSe Content See interlocking course Literature See interlocking course Sourse L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Course L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Function Yup Recitation Section (large) Hrs/wk 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	Lecturer	Prof. Robert Seifried
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Literature See interlocking course Course L1139: Mechanics IV (Kinetter II, Oscillations, Analytical Mechanics, Multibody Systems) Course L1139: Mechanics IV (Kinetter II, Oscillations, Analytical Mechanics, Multibody Systems) Typ Recitation Section (large) Hrs/wk 1 Orgen 1 Workload in Hours Independent Study Time 16, Study Time in Lecture 14 Lecturer Prof. Robert Seifried Language DE Content See interlocking course	Cycle	SoSe
Course L1139: Mechanics IV (Kinetics II, Oscillations, Analytical Mechanics, Multibody Systems) Typ Recitation Section (large) Hrs/wk 1 0 P 1 Independent Study Time 16, Study Time in Lecture 14 Lecturer Prof. Robert Seifried Language DE Cycle SoSe Content See interlocking course	Content	See interlocking course
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Hrs/wk 1 CP 1 Workload in Hours Independent Study Time 16, Study Time in Lecture 14 Lecture Prof. Robert Seifried Language DE Cycle SoSe Content See interlocking course	Course L1139: Mechanics IV (Kinet	ics II, Oscillations, Analytical Mechanics, Multibody Systems)
CP 1 Workload in Hours Independent Study Time 16, Study Time in Lecture 14 Lecture Prof. Robert Seifried Language DE Cycle SoSe Content See interlocking course	Тур	Recitation Section (large)
Workload in Hours Independent Study Time 16, Study Time in Lecture 14 Lecture Prof. Robert Seifried Language DE Cycle SoSe Content See interlocking course	Hrs/wk	1
Lecturer Prof. Robert Seifried Language DE Cycle SoSe Content See interlocking course	CP	1
Language DE Cycle SoSe Content See interlocking course	Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Cycle SoSe Content See interlocking course	Lecturer	Prof. Robert Seifried
Content See interlocking course	Language	DE
	Cycle	SoSe
Literature See interlocking course	Content	See interlocking course
	Literature	See interlocking course



Module M0956: Measureme	ent Technology for Mechanical and Proc	ess Engineers		
0				
Courses		Turn	Hrobult	CD
Title Brastical Course: Massurement and Cont	ral Systems (L1110)	Typ	Hrs/wk 2	CP 2
Practical Course: Measurement and Contr Measurement Technology for Mechanical		Laboratory Course Lecture	2	3
Veasurement Technology for Mechanical		Recitation Section (large)	1	1
Module Responsible		·····(
Admission Requirements	none			
Recommended Previous	Basic knowledge of physics, chemistry and electrical e	angineering		
Knowledge	basic knowledge of physics, chemistry and electrical e	ngineening		
Educational Objectives	After taking part successfully, students have reached t	be following learning results		
Professional Competence	Alter laking part successionly, succents have reacted t	le blowing learning leads		
	Students are able to name the most important fundm	antals of the Massurement Technology (Quantition	and Unite Uncortaint	Calibration Static an
Knowledge	Students are able to name the most important fundme Dynamic Properties of Sensors and Systems).	entais of the Measurement rechnology (Quantities	and onits, oncertainty	, Calibration, Static an
	Dynamic Properties of Sensors and Systems).			
	They can outline the most important measuring metho	ds for different kinds of quantities to be maesured	(Electrical Quantities,	Femperature, mechanica
	quantities, Flow, Time, Frequency).			
		lucia (Cas Casara Casatracas) Cas Chromoto		
	They can describe important methods of chemical Ana	uysis (Gas Sensors, Spectroscopy, Gas Chromatog	(raphy)	
Skills	Students can select suitable measuring methods to give	ven problems and can use refering measurement o	levices in practice.	
	The students are able to orally explain issues in the s	ubject area of measurement technology and solut	ion approaches as wel	I as place the issues in
	the right context and application area.	,		
Personal Competence				
Social Competence	Students can arrive at work results in groups and docu	iment them in a common report.		
Autonomy	Students are able to familiarize themselves with new r	neasurement technologies.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 7	0		
Credit points	6	-		
Examination	Written exam			
Examination duration and scale	105 minutes			
Assignment for the Following	General Engineering Science (German program): Spe	cialisation Energy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Spe		companyory	
ourricula	General Engineering Science (German program): Spe			
	General Engineering Science (German program): Spe			
	General Engineering Science (German program, 7 se		naineerina: Compulso	v
	General Engineering Science (German program, 7 se			•
	General Engineering Science (German program, 7 se			
	General Engineering Science (German program, 7 se			
	Energy and Environmental Engineering: Core qualific		- 2	
	General Engineering Science (English program): Spe		Compulsory	
	General Engineering Science (English program): Spe	6, 6 6	1	
	General Engineering Science (English program): Spe			
	General Engineering Science (English program): Spe			
	General Engineering Science (English program, 7 ser		ngineering: Compulsor	у
	General Engineering Science (English program, 7 ser	, ,	0 0 1	
	General Engineering Science (English program, 7 ser			
	General Engineering Science (English program, 7 ser			
	Mechanical Engineering: Core qualification: Compuls			
	Mechatronics: Core qualification: Compulsory			
	Process Engineering: Core qualification: Compulsory			



ourse L1119: Practical Course: Me	easurement and Control Systems	
Тур	Laboratory Course	
Hrs/wk	2	
CP	2	
Workload in Hours	ndependent Study Time 32, Study Time in Lecture 28	
Lecturer	Dr. Wolfgang Schröder	
Language	DE	
Cycle	WiSe/SoSe	
Content	Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants in automotive exhaust are used.	
	Experiment 2: Simulation and measurement of asynchrone engine and rotary pump: the dynamic behaviour of e pump engine will be investigated. The starting will be simulated on a PC and compared with measurement.	
	Experiment 3: Michelson interferometer and fiber optic: fundamental optical phenonema will be understood and applications with Michelson interferometer and optical fibers demonstrated.	
	Experiment 4:Identification of the parameters of a control system and optimal control parameters	
	 Leith, W.: Die Analyse der Luft und ihrer Verunreinigung in der freien Atmosphäre und am Arbeitsplatz. 2. Aufl., Wissenschaftlicher Verlagsgesellschaft, Stuttgart, 1974 Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, München Wien, 1979 Luftbericht 83/84, Freie und Hansestadt Hamburg, Behörde für Bezirksangelegenheiten, Naturschutz und Umweltgestaltung Gebrauchs- und Bedienungsanweisungen VDI-Handbuch Reinhaltung der Luft, Band 5: VDI-Richtlinien 2450 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 	



Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Sven Krause
Language	DE
Cycle	WiSe 1 Fundamentals
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 Techn	ourse L1118: Measurement Technology for Mechanical and Process Engineers		
Тур	Recitation Section (large)		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Dr. Sven Krause		
Language	DE		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		



Courses				
ïtle		Тур	Hrs/wk	CP
troduction to Management (L0880)		Lecture Problem-based Learning	3 2	3 3
Project Entrepreneurship (L0882)	Drof Christoph Ibl	Problem-based Learning	2	3
Module Responsible				
Admission Requirements Recommended Previous				
Knowledge	-			
Educational Objectives		Nowing learning results		
Professional Competence		nowing learning results		
Knowledge			nagement, from Planr	ning and Organisation
	 explain the differences between Economics and Mifield of Management explain the most important aspects of and goals in a describe and explain basic business functions as ressource management, information management, explain the relevance of planning and decision misome basic methods from mathematical Finance state basics from accounting and costing and select Students are able to analyse business units with relevance or galand structure them approximate analyse Management goals and structure them approximate analyse organisational and staff structures of compapily methods for decision making under multiple or analyse and apply basic methods of marketing select and apply basic methods from mathematical apply basic methods from accounting, costing and or apply basic methods from accounting, costing and staff 	Management and name the most important aspe production, procurement and sourcing, supply innovation management and marketing naking in Business, esp. in situations under mu sted controlling methods. spect to different criteria (organization, object able to propriately vanies objectives, under uncertainty and under risk Business information systems finance to predefined problems	cts of entrepmeurial p chain management, o Itiple objectives and	projects organization and hum uncertainty, and expl.
Personal Competence Social Competence Autonomy	Students are able to work successfully in a team of students to apply their knowledge from the lecture to an entre to communicate appropriately and to cooperate respectfully with their fellow students.	epreneurship project and write a coherent report	on the project	
	work in a team and to organize the team themselveto write a report on their project.	os		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
	90 Minuten			
Examination duration and scale	1	sation Electrical Engineering: Compulsory		
	General Engineering Science (German program): Speciali	Sation Electroa Engineering. Compaisory		
Examination duration and scale	0 0 1 0 1 1			
Examination duration and scale Assignment for the Following	0 0 (10 / 1	sation Computer Science: Compulsory		
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali	isation Computer Science: Compulsory isation Process Engineering: Compulsory		
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program): Speciali General Engineering Science (German program): Speciali General Engineering Science (German program): Speciali	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co		
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program): Speciali	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co		
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program): Speciali	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Con isation Mechanical Engineering: Compulsory		
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program): Speciali	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory		
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program): Speciali	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory	mpulsory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program): Speciali	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Comp	ulsory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	isation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Con isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Computer): Specialisation Process Engineering: Computer	mpulsory ulsory Isory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	isation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Con isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Computer): Specialisation Process Engineering: Computer): Specialisation Biomedical Engineering: Computer): Specialisation Biomedical Engineering: Computer): Specialisation Biomedical Engineering: Comp	mpulsory ulsory Isory npulsory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	isation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engeneering: Con isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Computer): Specialisation Process Engineering: Computer): Specialisation Biomedical Engineering: Computer): Specialisation Biomedical Engineering: Computer): Specialisation Biomedical Engineering: Computer): Specialisation Naval Architecture: Compulsory	mpulsory ulsory lsory ıpulsory ıry	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	isation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co isation Civil- and Enviromental Engineering: Co isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Computer): Specialisation Process Engineering: Computer): Specialisation Biomedical Engineering: Computer): Specialisation Biomedical Engineering: Computer): Specialisation Naval Architecture: Compulsory ter): Specialisation Biomedical Engineering: Computer): Specialisation Computer Science: Compulsory	mpulsory ulsory lsory npulsory ory ory	
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	isation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co- isation Civil- and Enviromental Engineering: Co- isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Compu- ter): Specialisation Process Engineering: Compu- ter): Specialisation Biomedical Engineering: Compu- ter): Specialisation Naval Architecture: Compulsory ter): Specialisation Naval Architecture: Compulsory ter): Specialisation Computer Science: Compulsory ter): Specialisation Bioprocess Engineering: Com-	mpulsory lisory lsory npulsory pry pry npulsory	
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Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co- isation Civil- and Enviromental Engineering: Co- isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Compu- ter): Specialisation Biomedical Engineering: Compu- ter): Specialisation Biomedical Engineering: Compu- ter): Specialisation Biomedical Engineering: Compu- ter): Specialisation Naval Architecture: Compulsor ter): Specialisation Computer Science: Compulsor ter): Specialisation Bioprocess Engineering: Com- ter): Specialisation Civil Engineering: Compulsor ter): Specialisation Energy and Enviromental Eng- ter): Specialisation Mechanical Engineering, Foc	mpulsory lisory lisory npulsory ory npulsory y jineering: Compulsor us Mechatronics: Cor	npulsory
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program, 7 semest General Engineering Science (German program, 7 semest	sation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co- isation Civil- and Enviromental Engineering: Co- isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Compu- ter): Specialisation Process Engineering: Compu- ter): Specialisation Biomedical Engineering: Compu- ter): Specialisation Naval Architecture: Compulsor ter): Specialisation Computer Science: Compulsor ter): Specialisation Bioprocess Engineering: Com- ter): Specialisation Civil Engineering: Compulsor ter): Specialisation Energy and Enviromental Eng- ter): Specialisation Mechanical Engineering, Foc- ter): Specialisation Mechanical Engineering, Foc- ter): Specialisation Mechanical Engineering, Foc- ter): Specialisation Mechanical Engineering, Foc-	ulsory lsory pulsory pry pry pulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems Ei	, npulsory mpulsory ngineering: Compulso
Examination duration and scale Assignment for the Following	General Engineering Science (German program): Speciali General Engineering Science (German program, 7 semest General Engineering Science (German program), 7 semest General Engineering Science (German p	isation Computer Science: Compulsory isation Process Engineering: Compulsory isation Bioprocess Engineering: Compulsory isation Energy and Enviromental Engineering: Co- isation Civil- and Enviromental Engineering: Co- isation Mechanical Engineering: Compulsory isation Biomedical Engineering: Compulsory isation Naval Architecture: Compulsory isation Naval Architecture: Compulsory ter): Specialisation Electrical Engineering: Compu- ter): Specialisation Process Engineering: Compu- ter): Specialisation Biomedical Engineering: Compu- ter): Specialisation Naval Architecture: Compulsor ter): Specialisation Bioprocess Engineering: Compu- ter): Specialisation Civil Engineering: Compulsor ter): Specialisation Energy and Enviromental Eng- ter): Specialisation Mechanical Engineering, Foc- ter): Specialisation Mechanical Engineering, Foc-	ulsory lsory pulsory pry pry pulsory y gineering: Compulsor us Mechatronics: Cor us Biomechanics: Co us Aircraft Systems Ei g, Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Scienc



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



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

Course L0882: Project 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 Biomechanics

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

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



Course L0384: Introduction to Anatomy		
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	DE	
Content	SoSe General Anatomy	
Content	1 st week: The Eucaryote Cell	
	2 nd week: The Tissues	
	3 rd week: Cell Cycle, Basics in Development	
	4 th week: Musculoskeletal System	
	5 th week: Cardiovascular System	
	6 th week: Respiratory System	
	7 th week: Genito-urinary System	
	8 th week: Immune system	
	9 th week: Digestive System I	
	10 th week: Digestive System II	
	11 th week: Endocrine System	
	12 th week: Nervous System	
	13 th week: Exam	
Literature	Adolf Faller/Michael Schünke, Der Körper des Menschen, 16. Auflage, Thieme Verlag Stuttgart, 2012	



ourses				
tle		Тур	Hrs/wk	CP
roduction to Radiology and Radiation Th	erapy (L0383)	Lecture	2	3
Module Responsible	Prof. Ulrich Carl			
Admission Requirements	None			
Recommended Previous	None			
Knowledge Educational Objectives				
Professional Competence	After taking part successfully, students have re	acred the following learning results		
Knowledge				
	Therapy			
	The students can distinguish different types of	currently used equipment with respect to its use in rad	iation 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 sec 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 m	nethod depending on the patient's clinical history and n	leeds.	
	The student can explain the influence of techn	ical errors on the imaging techniques.		
	The student can draw the right conclusions ba	sed on the images' diagnostic findings or the error pro	tocol.	
Skills				
Skiis	Therapy			
		iative situations and motivate why they came to that co	nelucion	
	The students can distinguish curative and pair	alive situations and motivate willy they came to that co	nclusion.	
	The students can develop adequate therapy c	oncepts and relate it to the radiation biological aspects	3.	
	The students can use the therapeutic principle	e (effects vs adverse effects)		
	The students can distinguish different kinds of energy needed in that situation (irradiation pla	of radiation, can choose the best one depending on inning).	the situation (location of the	e tumor) and choose t
	The student can assess what an individual ps social services, psycho-oncology).	sychosocial service should look like (e.g. follow-up tre	atment, sports, social help ç	groups, self-help group
	Diagnostics			
	The students can suggest solutions for repairs	of imaging instrumentation after having done error an	alyses.	
	The students can classify results of imaging to	echniques according to different groups of diseases b	ased on their knowledge of	anatomy nathology a
	pathophysiology.	continues according to different groups of diseases b	ased on their knowledge of	anatomy, patrology a
Personal Competence				
Social Competence				
	The students can assess the special social situ	uation of tumor patients and interact with them in a pro	fessional way.	
	The students are aware of the special, often fe	ear-dominated behavior of sick people caused by diag	nostic and therapeutic meas	ures and can meet the
	appropriately.		·	
Autonomy				
,	The students can apply their new knowledge a	and skills to a concrete therapy case.		
	The students can introduce younger students	to the clinical daily routine.		
	The students are able to access anatomical	knowledge by themselves, can participate compete	ontly in conversations on th	e topic and acquire t
	relevant knowledge themselves.	niowodgo by monocives, oan partopato compete		
Workload in Hours	Independent Study Time 62, Study Time in Lea	cture 28		
Credit points	3			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following		am): Specialisation Mechanical Engineering, Focus Bio		
Curricula		am): Specialisation Biomedical Engineering: Compulso am, 7 semester): Specialisation Biomedical Engineerin		
		am, 7 semester): Specialisation Bonneulcal Engineerin am, 7 semester): Specialisation Mechanical Engineerin		mpulsory
	Electrical Engineering: Specialisation Medical			
		m): Specialisation Mechanical Engineering, Focus Bio		
	General Engineering Science (English progra	m): Specialisation Biomedical Engineering: Compulso	ry	
		m, 7 semester): Specialisation Mechanical Engineerin		nnulaan:

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



Mechanical Engineering: Specialisation Biomechanics: Compulsory Biomedical Engineering: Specialisation Medical Technology and Control Theory: Elective Compulsory Biomedical Engineering: Specialisation Management and Business Administration: Elective Compulsory Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory Technomathematics: Specialisation III. Engineering. Science: Elective Compulsory

Course L0383: Introduction to Radio	ology and Radiation Therapy	
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	ndependent Study Time 62, Study Time in Lecture 28	
Lecturer Language	Prof. Ulrich Carl, Prof. Thomas Vestring DE	
Cycle		
	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 M0646: BIO I: Impla	nts and Testing			
courses				
ïtle		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 Frakturheilu	ing" before attending "Experimentelle	e Methoden".	
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	The students can describe the different ways how bones heal, and the requirements for their existence.			
	The state is a second different to state state of a discovery state of the second stat	. United and the state of the s	and a first frage	
	The students can name different treatments for the spine and h	bliow bones under given fracture mor	rphologies.	
	The students can describe different measurement techniques for	or forces and movements, and choose	e the adequate technique for	a given task.
Skills	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 experi	mental techniques used in biomecha	inics.	
Personal Competence				
Social Competence				
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): Specialisatic	n Mechanical Engineering, Focus Bi	omechanics: Compulsory	
Curricula	General Engineering Science (German program): Specialisatio	n Biomedical Engineering: Compulsi	ory	
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineerin	ng, Focus Biomechanics: Cor	npulsory
	General Engineering Science (German program, 7 semester):	Specialisation Biomedical Engineerir	ng: Compulsory	
	General Engineering Science (English program): Specialisatio	n Biomedical Engineering: Compulso	ory	
	General Engineering Science (English program): Specialisatio	n Mechanical Engineering, Focus Bic	omechanics: Compulsory	
	General Engineering Science (English program, 7 semester): S	pecialisation Mechanical Engineerin	ng, Focus Biomechanics: Com	pulsory
	General Engineering Science (English program, 7 semester): S	pecialisation Biomedical Engineerin	g: Compulsory	
	Mechanical Engineering: Specialisation Biomechanics: Compu	llsory		
	Biomedical Engineering: Specialisation Artificial Organs and R	egenerative Medicine: Elective Comp	oulsory	
	Biomedical Engineering: Specialisation Implants and Endopros	stheses: Elective Compulsory		
	Biomedical Engineering: Specialisation Medical Technology at	nd Control Theory: Elective Compulse	ory	
	Biomedical Engineering: Specialisation Management and Busi	ness Administration: Elective Compu	Ilsory	
	Technomathematics: Specialisation III. Engineering Science: E	lective Compulsory		

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



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



Modulo M0669: Numerical	Mathematica I			
Module M0662: Numerical I	Mathematics I			
Courses				
Title		Тур	Hrs/wk	CP
Numerical Mathematics I (L0417)		Lecture	2	3
Numerical Mathematics I (L0418)		Recitation Section (small)	2	3
Module Responsible	Prof. Sabine Le Borne			
Admission Requirements	None			
Recommended Previous Knowledge	 Mathematik I + II for Engineering Students (german or engli basic MATLAB knowledge 	sh) or Analysis & Linear Algebra I + II fo	or Technomathematicia	ns
Educational Objectives	After taking part successfully, students have reached the following	earning results		
Professional Competence				
Knowledge	Students are able to			
	 name numerical methods for interpolation, integration, lea explain their core ideas, repeat convergence statements for the numerical methods, explain aspects for the practical execution of numerical methods 			inding problems and
Skills	Students are able to			
	 implement, apply and compare numerical methods using N justify the convergence behaviour of numerical methods wi select and execute a suitable solution approach for a given 	h respect to the problem and solution a	lgorithm,	
Personal Competence				
Social Competence	Students are able to			
Autonomy	 work together in heterogeneously composed teams (i.e., t foundations and support each other with practical aspects r Students are capable to assess whether the supporting theoretical and practical end 	egarding the implementation of algorith xcercises are better solved individually	ims.	dge), explain theoreti
	 to assess their individual progess and, if necessary, to ask 	uestions and seek neip.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation C	omputer Science: Compulsory		
Curricula	General Engineering Science (German program): Specialisation N			
	General Engineering Science (German program): Specialisation M		s in Engineering Scien	ces: Compulsory
	General Engineering Science (German program): Specialisation B			
	General Engineering Science (German program, 7 semester): Spe			Faciles and Colored
	General Engineering Science (German program, 7 semester): Compulsory	specialisation mechanical Engineenr	ig, Focus Materiais in	Engineering Scienc
	General Engineering Science (German program, 7 semester): Spe	vialisation Biomedical Engineering: Co	moulsory	
	General Engineering Science (German program, 7 semester): Spe			mpulsory
	Bioprocess Engineering: Specialisation A - General Bioprocess Er	0 0,		
	Computer Science: Specialisation Computational Mathematics: Ele			
	Electrical Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program): Specialisation Co	mputer Science: Compulsory		
	General Engineering Science (English program): Specialisation Bi	omedical Engineering: Compulsory		
	General Engineering Science (English program): Specialisation M	echanical Engineering, Focus Biomech	anics: Compulsory	
	General Engineering Science (English program): Specialisation M	echanical Engineering, Focus Materials	s in Engineering Scienc	ces: Compulsory
	General Engineering Science (English program, 7 semester): Spec	ialisation Computer Science: Compuls	sory	
	General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineerin	g, Focus Materials in	Engineering Science
	Compulsory			
	General Engineering Science (English program, 7 semester): Spec			
	General Engineering Science (English program, 7 semester): Spec		cus Biomechanics: Con	npulsory
	Computational Science and Engineering: Core qualification: Comp			
	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	



Nodule M0684: Heat Trans	fer			
Courses				
itle		Тур	Hrs/wk	CP
leat Transfer (L0458) leat Transfer (L0459)		Lecture Recitation Section (large)	3 2	5 1
Module Responsible	Dr. Andreas Moschallski	recitation occurr (large)	L	
Admission Requirements	none			
Recommended Previous	Technical Thermodynamics I, II and Fluid Dynamics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follo	owing learning results		
Professional Competence	Aller laking part successiony, students have reached the long	Swing learning results		
Knowledge	The students are able to			
Nilowiedge				
	- describe the different physical mechanism of Heat Transfer	3		
	- explain the technical terms,			
	- p			
	- to analyse comlex heat transfer processes in a critical way.			
Skills	The students are able to			
	- understand the physics of Heat Transfer,			
	- calculate and evaluate complex Heat Transfer processes,			
	- solve excersises self-consistent and in small groups.			
Personal Competence				
Social Competence	The students are able to discuss in small groups and develo	p an approach.		
Autonomy		insistent and analyse the results in a critical wa	ay. A qualified exchan	ge with other students
	given.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisa	ation Mechanical Engineering, Focus Biomecha	anics: Compulsory	
Curricula		ation Mechanical Engineering, Focus Energy S	ystems: Compulsory	
	General Engineering Science (German program): Specialisa	ation Biomedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisa	ation Mechanical Engineering, Focus Theoretic	al Mechanical Engine	ering: Compulsory
	General Engineering Science (German program, 7 semester	r): Specialisation Mechanical Engineering, Foc	us Energy Systems: C	Compulsory
	General Engineering Science (German program, 7 semes	ster): Specialisation Mechanical Engineering,	Focus Theoretical N	lechanical Engineerir
	Compulsory			
	General Engineering Science (German program, 7 semester		npulsory	
	General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory		
	General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomecha	anics: Compulsory	
	General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomecha tion Mechanical Engineering, Focus Energy Sy	anics: Compulsory ystems: Compulsory	ering: Compulsory
	General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomecha tion Mechanical Engineering, Focus Energy Sy tion Mechanical Engineering, Focus Theoretic	nics: Compulsory ystems: Compulsory al Mechanical Engine	
	General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomecha tion Mechanical Engineering, Focus Energy Sy tion Mechanical Engineering, Focus Theoretic): Specialisation Mechanical Engineering, Focu	nics: Compulsory ystems: Compulsory al Mechanical Engine us Energy Systems: C	ompulsory
	General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 semester	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomecha tion Mechanical Engineering, Focus Energy Sy tion Mechanical Engineering, Focus Theoretic): Specialisation Mechanical Engineering, Focu	nics: Compulsory ystems: Compulsory al Mechanical Engine us Energy Systems: C	ompulsory
	General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomecha tion Mechanical Engineering, Focus Energy Sy tion Mechanical Engineering, Focus Theoretic): Specialisation Mechanical Engineering, Focu ter): Specialisation Mechanical Engineering,	nics: Compulsory ystems: Compulsory al Mechanical Engine us Energy Systems: C Focus Theoretical M	ompulsory
	General Engineering Science (German program, 7 semester General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 semester	tion Biomedical Engineering: Compulsory tion Mechanical Engineering, Focus Biomecha tion Mechanical Engineering, Focus Energy Sy tion Mechanical Engineering, Focus Theoretic): Specialisation Mechanical Engineering, Focu ter): Specialisation Mechanical Engineering;): Specialisation Biomedical Engineering: Com	nics: Compulsory ystems: Compulsory al Mechanical Engine us Energy Systems: C Focus Theoretical M	ompulsory

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



Module M1279: MED II: Intr	oduction to Biochemistry and Molec	ular Biology		
Courses				
Title	P: 1 (19999)	Тур	Hrs/wk	CP
ntroduction to Biochemistry and Molecula		Lecture	2	3
Module Responsible	Prof. Hans-Jürgen Kreienkamp			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ned the following learning results		
Professional Competence				
Knowledge				
	The students can			
	 describe basic biomolecules; 			
	 explain how genetic information is coded in 	in the DNA:		
	 explain the connection between DNA and 			
		F,		
Skills				
	The students can			
	 recognize the importance of molecular particular part	rameters for the course of a disease:		
	describe different molecular-diagnostic tre			
	-			
	describe the importance of those treatments for so	ome diseases;		
Personal Competence				
Social Competence				
	The students can conduct discussions in research	n and medicine on a technical level.		
Autonomy	The students can develop understanding of topics	s from the course, using technical literature, by thems	elves	
Workload in Hours	Independent Study Time 62, Study Time in Lectur	re 28		
Credit points	3			
Examination	Written exam			
Examination duration and scale	60 minutes			
		Presidiation Mechanical Engineering Focus Pion	achanica: Compulson	
Assignment for the Following Curricula		: Specialisation Mechanical Engineering, Focus Bion : Specialisation Biomedical Engineering: Compulsor		
Curreula		7 semester): Specialisation Biomedical Engineering:		
		7 semester): Specialisation Biomedical Engineering. 7 semester): Specialisation Mechanical Engineering.		mpulsory
	Electrical Engineering: Specialisation Medical Te	, , , , , , , , , , , , , , , , , , , ,	, · • • • • • • • • • • • • • • • • • •	
		Specialisation Mechanical Engineering, Focus Biom	echanics: Compulsory	
		Specialisation Biomedical Engineering: Compulsory		
		7 semester): Specialisation Mechanical Engineering,		npulsory
		7 semester): Specialisation Biomedical Engineering:		
	Mechanical Engineering: Specialisation Biomech			
		nent and Business Administration: Elective Compuls	ory	
		Drgans and Regenerative Medicine: Elective Compu		
	Biomedical Engineering: Specialisation Medical	Fechnology and Control Theory: Elective Compulsory	/	
	Biomedical Engineering: Specialisation Implants	and Endoprostheses: Elective Compulsory		
	Technomathematics: Core qualification: Elective (Compulsory		
	Technomathematics: Specialisation III. Engineering	ng Science: Elective Compulsory		

Course L0386: Introduction to Bioch	nemistry 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 M1280: MED II: Intr	oduction to Physiology	
Courses		
Title	Typ Hrs/wk CP	
Introduction to Physiology (L0385)	Typ Hrs/wk CP Lecture 2 3	
		—
Module Responsible		
Admission Requirements	None	
Recommended Previous	None	
Knowledge	Advantal Second and a second distribution of the Colling Section Second and the	
Educational Objectives	After taking part successfully, students have reached the following learning results	
Professional Competence		
Knowledge		
	The students can	
	describe the basics of the energy metabolism;	
	 describe 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 function	ns) 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 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 Management and Business Administration: Elective Compulsory	
	Biomedical Engineering: Specialisation Artificial Organs and Regenerative Medicine: Elective Compulsory	
	Biomedical Engineering: Specialisation Implants and Endoprostheses: Elective Compulsory	
	Technomathematics: Core qualification: Elective Compulsory	
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory	

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



Focus Energy Systems

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

	Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	CP
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Advanced Mechanical Engineering Desigr Advanced Mechanical Engineering Desigr		Lecture Recitation Section (large)	2	2
Module Responsible		Hecitation Section (large)	2	I
Admission Requirements	None			
Recommended Previous	Fundamentals of Mechanical Engineering Desig	jn		
Knowledge	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
Educational Obligations		. Allow to a low order or and the		
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	explain complex working principles and function	is of machine elements and of basic elements of flu	idics,	
	• explain requirements, selection criteria, applicat	ion scenarios and practical examples of complex m	achine elements,	
	 indicate the background of dimensioning calculation 	ations.		
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of covere	d machine elements,		
		w requirements and tasks (problem solving skills),		
	 recognize the content of technical drawings and 			
	 evaluate complex designs, technically. 			
	· · · · · · · · · · · · · · · · · · ·			
Personal Competence				
Social Competence	. Otudanta ara akia ta diasuas taskaisal informati			
	 Students are able to discuss technical information 	on in the recture supported by activating methods.		
Autonomy				
	 Students are able to independently deepen their 			
		edge 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 112			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Spec	ialisation Mechanical Engineering, Focus Energy S	systems: Compulsory	
Curricula	General Engineering Science (German program): Spec			Compulsory
	General Engineering Science (German program): Spec			
	General Engineering Science (German program): Spec			
	General Engineering Science (German program): Spec	• •		duction: Compulsory
	General Engineering Science (German program): Spec	• •		
	General Engineering Science (German program, 7 sem	• •	•	
	General Engineering Science (German program, 7 s			
	Compulsory		,	
	General Engineering Science (German program, 7 sem	ester): Specialisation Mechanical Engineering, For	us Mechatronics: Co	mpulsory
		emester): Specialisation Mechanical Engineering,		
	General Engineering Science (German program, 7 se			
	Compulsory	emester). Specialisation Mechanical Engineering	Focus Theoretical I	Mechanical Engineer
	Compulsory General Engineering Science (German program, 7 s	emester): Specialisation Mechanical Engineering	Focus Theoretical I	Mechanical Enginee
	Compulsory General Engineering Science (German program, 7 s Compulsory			-
	Compulsory General Engineering Science (German program, 7 s Compulsory General Engineering Science (German program, 7 sem	ester): Specialisation Mechanical Engineering, For	us Biomechanics: Co	mpulsory
	Compulsory General Engineering Science (German program, 7 s Compulsory General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem	ester): Specialisation Mechanical Engineering, Foc ester): Specialisation Mechanical Engineering, Foc	cus Biomechanics: Co cus Energy Systems: (mpulsory
	Compulsory General Engineering Science (German program, 7 s Compulsory General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (English program): Speci	ester): Specialisation Mechanical Engineering, Foc lester): Specialisation Mechanical Engineering, Foc alisation Mechanical Engineering, Focus Energy S	sus Biomechanics: Co sus Energy Systems: (ystems: Compulsory	impulsory Compulsory
	Compulsory General Engineering Science (German program, 7 s Compulsory General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (English program): Speci General Engineering Science (English program): Speci	ester): Specialisation Mechanical Engineering, Foc iester): Specialisation Mechanical Engineering, Foc alisation Mechanical Engineering, Focus Energy S alisation Mechanical Engineering, Focus Aircraft S	eus Biomechanics: Co eus Energy Systems: (ystems: Compulsory ystems Engineering: (ompulsory Compulsory Compulsory
	Compulsory General Engineering Science (German program, 7 s Compulsory General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci	ester): Specialisation Mechanical Engineering, Foc iester): Specialisation Mechanical Engineering, Foc alisation Mechanical Engineering, Focus Energy S alisation Mechanical Engineering, Focus Aircraft S alisation Mechanical Engineering, Focus Materials	sus Biomechanics: Co sus Energy Systems: (ystems: Compulsory ystems Engineering: (in Engineering Scien	ompulsory Compulsory Compulsory
	Compulsory General Engineering Science (German program, 7 s Compulsory General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci	ester): Specialisation Mechanical Engineering, Foc lester): Specialisation Mechanical Engineering, Foc alisation Mechanical Engineering, Focus Energy S alisation Mechanical Engineering, Focus Aircraft S alisation Mechanical Engineering, Focus Materials alisation Mechanical Engineering, Focus Materials	us Biomechanics: Cc us Energy Systems: (ystems: Compulsory ystems Engineering: (in Engineering Scien nics: Compulsory	ompulsory Compulsory Compulsory ces: Compulsory
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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: Steinhilber, W., Böner, R., Springer Verlag, aktuelle Auflage. 			
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. 			
	 Emunrung in die Dirk-Normen, Nien, Neubner-Verlag. Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage. 			
	 Konstruktionstenre, Pani, G.; Beitz, W., Springer-venag, aktuelle Auflage. Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. 			
	 Maschinenelemente 1-2; Schecht, B., Pearson Verlag, aktuelle Auliage. 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. 			
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	Sowie weitere Bücher zu speziellen Themen			

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



Course L0262: Advanced Mechanic	al Engineering Design I
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	Advanced Mechanical Engineering Design I & II
	Lecture
	E selementele fille fillenties ersteller stereste
	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.
	 Bubber, raschenderna der Maschmenbad, dieb, K-r., Ferndesen, S.(msg.), Springer-Verlag, aktiene Auflage. Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage. Eistähenen in die Dib Neumann Klein M. Tauhana Varlage
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag. Konstruktionslahre Debl. C.: Beite W. Springers Verlag, aktuelle Auflage
	Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Bücher zu speziellen Themen

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



Module M0655: Computation	onal Fluid Dynamics I				
Courses					
Title		Тур	Hrs/wk	CP	
Computational Fluid Dynamics I (L0235)		Lecture	2	3	
Computational Fluid Dynamics I (L0419)		Recitation Section (large)	2	3	
Module Responsible	Prof. Thomas Rung				
Admission Requirements	None				
Recommended Previous	 Mathematical Methods for Engineers 				
Knowledge	 Fundamentals of Differential/integral calculus and series 	expansions			
Educational Objectives	After taking part successfully, students have reached the followi	ng learning results			
Professional Competence					
Knowledge	The students are able to list the basic numerics of partial different	ntial equations.			
Skills	The students are able develop appropriate numerical integra	tion 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	them.			
Autonomy	The students can independently analyse approaches to solving	specific problems.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56				
Credit points	6				
Examination	Written exam				
Examination duration and scale	2h				
Assignment for the Following	General Engineering Science (German program): Specialisation		Systems: Compulsory		
Curricula					
	General Engineering Science (German program, 7 semester): Specialisation Naval Architecture: Compulsory				
	General Engineering Science (German program, 7 semester): S		cus Energy Systems: I	Elective Compulsory	
	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	pecialisation Mechanical Engineering, For	us Energy Systems: E	lective Compulsory	
	Naval Architecture: Core qualification: Compulsory				
	Technomathematics: Specialisation III. Engineering Science: Elective Compulsory				
	Technomathematics: Specialisation III. Engineering Science: El	ective Compulsory			

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



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



Module M0639: Gas and St	team Power Plants				
Courses					
Title		Тур	Hrs/wk	CP	
Gas and Steam Power Plants (L0206)		Lecture	3	4	
Gas and Steam Power Plants (L0210)		Recitation Section (large)	2	2	
Module Responsible	Prof. Alfons Kather				
Admission Requirements	None				
Recommended Previous					
Knowledge	 "Technical Thermodynamics Land II" 				
	• "Heat Transfer"				
	"Fluid Mechanics"				
Educational Objectives	After taking part successfully, students have reached the following learni	ng results			
Professional Competence		3			
Knowledge	The students can evaluate the development of the electricity demand an	d the energy conversion routes i	in the thermal power pla	ant. describe the various	
	types of power plant and the layout of the steam generator block and d				
	describe the exhaust gas cleaning apparatus and other environmental				
	fossil-fuelled power plants and regenerative (solar, wind) power plants o	r plants equipped with Carbon C	apture and Storage.		
	The students are a basis to students which a students are the				
	The students can on a basic level explain principles, operation and des acidification, fine particulate or CO ₂ emissions and the resulting climati				
	from interconnecting conventional power plants and renewable energy	sources and can name the op	timai tecnnical options	for providing security of	
	supply and network stability, also with economics considered.				
Skills	The students are able, using theories and methods of the energy tec	hnology from fossil fuels and b	ased on deep knowled	lge on the function and	
	construction of gas and steam power plants, to identify basic associa	tions in the production of heat	and electricity, so as t	o develop conceptiona	
	solutions. Through analysis of the problem and exposure to the inhere	ent interconnections between he	eat and power generati	on, the students will be	
	endowed with the capability and methodology to develop realistic opt	imal concepts for the environme	entally benign generati	on of electricity and the	
	production of heat. From the technical basics the students become the ability to follow better the deliberations on the electricity mix composition within				
	the energy-political triangle (economy, secure supply and environmental protection).				
	The students are able to highlight aspects of the design and development of power plant cycles with the specialised software suite EBSILON				
	Professional TM and to independently program simplified power plant pro	cess simulations.			
	The students are able to do simplified calculations of turbo machinery as	either an overall plant or as indiv	vidual stages.		
Personal Competence					
Social Competence	The students are able to solve subject-specific exercises in smalls group	os and can present their common	results orally.		
	The students are able to analyze suitable technical alternatives to redu	ico the opvironmental and cosis	al footorint of their ongi	pooring activition and to	
	support the energy revolution effectively.		a looiphint of their engr	neering activities and to	
	support the energy revolution encouvery.				
Autonomy	The students assisted by the tutors will be able to develop alone simple				
	theoretical and practical knowledge from the lecture is consolidated				
	conditions highlighted. The students are able to analyse independent	ly the operational performance	of steam power plants	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 Energy	and Enviromental Engineering:	Compulsory		
Curricula	General Engineering Science (German program): Specialisation Mechan	nical Engineering, Focus Energy	Systems: Compulsory		
	General Engineering Science (German program, 7 semester): Specialisa	ation Energy and Enviromental E	ngineering: Compulsor	/	
	General Engineering Science (German program, 7 semester): Specialisa	ation Mechanical Engineering, Fo	ocus Energy Systems: E	lective Compulsory	
	Energy and Environmental Engineering: Core qualification: Compulsory				
	General Engineering Science (English program): Specialisation Energy				
	General Engineering Science (English program): Specialisation Mechan				
	General Engineering Science (English program, 7 semester): Specialisa				
	General Engineering Science (English program, 7 semester): Specialisa	tion Mechanical Engineering, Fo	cus Energy Systems: El	ective Compulsory	
	Mechanical Engineering: Specialisation Energy Systems: Compulsory				



	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
	 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 CO2 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.
	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 or o
	operation problems and their solution approach.
	This activity hinges, however, upon the availability of support financing and as such it cannot always be guaranteed.
	This activity finges, nowever, upon the availability of support infancing and as such it cannot always be guaranteed.
Literature	
Literature	Kalide: Kraft- und Arbeitsmaschinen
	Thomas, H.J.: Thermische Kraftanlagen. Springer-Verlag, 1985
	Strauß, K.: Kraftwerkstechnik. Springer-Verlag, 2006
	Kugeler und Phlippen: Energietechnik. Springer-Verlag, 1990
	• T. Bohn (Hrsg.): Handbuchreihe Energie, Band 7: Gasturbinenkraftwerke, Kombikraftwerke, Heizkraftwerke und Industriekraftwerke, Technis
	Verlag Resch / Verlag TÜV Rheinland



Course L0210: Gas and Steam Powe	er Plants				
Тур					
Hrs/wk	2				
	2				
CP					
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28				
Lecturer	Prof. Alfons Kather				
Language	DE				
Cycle					
Content	 Energy balance of a fluid-flow machine 				
l	Theory of turbine and compressor stage Equal and positive pressure blading				
	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 Turner of Device Plant				
	Types of Power Plant				
	Layout of the power plant block Idividual elements of the power plant				
	 Individual elements of the power plant Cooling systems 				
	Flue gas cleaning				
	Operation characteristics of the power plant				
	Construction materials				
	Location of power plants				
	The environmental impact of acidification, fine particulate or CO_2 emissions and the resulting climatic effects are a special focus of the lecture and the lecture hall exercise. The challenges in plant operation from interconnecting conventional power plants and renewable energy sources are discussed and the technical options for providing security of supply and network stability are presented, also under consideration of cost effectiveness. In this critical review, focus is especially placed on the compatibility of the different solutions with the environment and climate. With this, the awareness for the responsibility of an engineer's own actions are emphasized and the potential extent of the different solutions presented clearly.				
	Within the framework of the exercise the students learn the use of the specialised software suite EBSILON Professional TM . With this tool small tasks are solved on the PC, to highlight aspects of the design and development of power plant cycles. The students present their results orally and can afterwards 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, Technischer 				
	Verlag Resch / Verlag TÜV Rheinland				



Iodule M0684: Heat Trans	for				
Iodule M0664: Heat Trans	ner				
ourses					
tle		Тур	Hrs/wk	CP	
eat Transfer (L0458)		Lecture	3	5	
eat Transfer (L0459)		Recitation Section (large)	2	1	
Module Responsible	Dr. Andreas Moschallski				
Admission Requirements	none				
Recommended Previous	Technical Thermodynamics I, II and Fluid Dynamics				
Knowledge					
Educational Objectives	After taking part successfully, students have reached the following learn	ing 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 approa	ach.			
Autonomy	The students are able to develop a complex problem self-consistent and	d analyse the results in a critical wa	av A qualified exchan	ae with other students	
hatonomy	given.			go maroaror cladoria	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70				
Credit points	6				
Examination	Written exam				
Examination duration and scale	120 min				
Assignment for the Following					
Curricula			ystems: Compulsory		
	General Engineering Science (German program): Specialisation Biome				
	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory				
	General Engineering Science (German program, 7 semester): Specialis				
	General Engineering Science (German program, 7 semester): Special	alisation Mechanical Engineering,	Focus ineoretical N	lechanical Engineeri	
	Compulsory				
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory				
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory				
	General Engineering Science (English program): Specialisation Mechan General Engineering Science (English program): Specialisation Mechan			ering: Compulsory	
	General Engineering Science (English program). Specialisation Mechan General Engineering Science (English program, 7 semester): Specialisa				
	General Engineering Science (English program, 7 semester): Specials				
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	General Engineering Science (English program, 7 semester): Specialisa	ation Biomedical Engineering: Com	pulsory		
	General Engineering Science (English program, 7 semester): Specialisa Mechanical Engineering: Specialisation Energy Systems: Compulsory	ation Biomedical Engineering: Com	ipulsory		

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



Module M1022: Reciprocat	ing Machinery			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Reciprocating Engines a	nd Turbomachinery - Part Reciprocating Engines (L0633)	Lecture	1	1
Fundamentals of Reciprocating Engines a	nd Turbomachinery - Part Reciprocating Engines (L0634)	Recitation Section (large)	1	1
Internal Combustion Engines I (L0059)		Lecture	2	2
Internal Combustion Engines I (L0639)		Recitation Section (large)	1	2
Module Responsible	Prof. Christopher Friedrich Wirz			
Admission Requirements	None			
Recommended Previous	Thermodynamics, Mechanics, Machine Elements			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the followin	g learning results		
Professional Competence				
Knowledge Skills Personal Competence Social Competence	As a result of the part module "Fundamentals of Reciprocating I machinery and describe the qualitative and quantitative correlati pumps. They are able to utilize technical terms and paramet furthermore to give an overview of charging systems, fuels and e related and operational problems. As a result of the part module "Internal Combustion Engines I", addition, they are able to utilize their knowledge of design, mech to explain, assess and develop engines as well as charging syst The students are skilled to employ basic and detail knowledge re assess, analyse and solve technical and operational problems a The students are able to communicate and cooperate in a profest	ons of operating methods and efficiencies ers as well as aspects regarding the d missions. The students are able to select a the students are able reflect and utilize th nanical and thermodynamic characteristics erms. Detailed knowledge is present regard egarding reciprocating machinery, their se nd to perform mechanical and thermodyna	of multiple types of er evelopment of power specific types of mach e state-of-the-art rega s and the approach of ding computer-aided p lection and operation amic design.	ngines, compressors and r density and efficiency inery and assess design arding efficiency limits. In similarity. They are able process design. . They are further able to
Autonomy	The widespread scope of gained knowledge enables the studen	ts to handle situations in their future profes	sion independently a	nd 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 S	ystems: Compulsory	
Curricula	General Engineering Science (German program, 7 semester): Sp	pecialisation Mechanical Engineering, Foc	us Energy Systems: C	Compulsory
	General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Energy Sy	stems: Compulsory	
	General Engineering Science (English program, 7 semester): Sp	ecialisation Mechanical Engineering, Focu	us Energy Systems: C	ompulsory
	Mechanical Engineering: Specialisation Energy Systems: Comp	ulsory		



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

Course I 0634: Fundamentals of Re	ourse L0634: Fundamentals of Reciprocating Engines and Turbomachinery - Part Reciprocating Engines	
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Christopher Friedrich Wirz	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

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



Course L0639: Internal Combustion Engines I	
Тур	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Wolfgang Thiemann
Language	DE
Cycle	SoSe
Content	Calculation of tasks to:
	 Design of of motors Real process calculation Charging methods Kinematics of the crank mechanism Forces in the engine
Literature	Vorlesungsskript



Focus Aircraft Systems Engineering

Master Energy Engineering or an ec Module M0597: Advanced	Mechanical Engineering Design			
	···· · · · · · · · · · · · · · · · · ·			
Courses			Hus forts	0.5
Title Advanced Mechanical Engineering Desigi	a II (1.0264)	Typ Lecture	Hrs/wk 2	CP 2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	2
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous				
Knowledge	 Fundamentals of Mechanical Engineering Design 			
	Mechanics			
	 Fundamentals of Materials Science 			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence	Alter laking part successiony, students have reached the follow			
Knowledge	After passing the module, students are able to:			
	• explain complex working principles and functions of ma	chine elements and of basic elements of flui	dics,	
	• explain requirements, selection criteria, application sce	narios and practical examples of complex m	achine elements,	
	• indicate the background of dimensioning calculations.			
o				
Skills	After passing the module, students are able to:			
	accomplish dimensioning calculations of covered mach	ine elements,		
	• transfer knowledge learned in the module to new require	ements and tasks (problem solving skills),		
	 recognize the content of technical drawings and schem 	atic sketches,		
	 evaluate complex designs, technically. 			
Personal Competence				
Social Competence	Students are able to discuss technical information in the	electure supported by activating methods		
		i colure supported by dolivaling methods.		
Autonomy	. Otividante pro obla ta indanandantividanana their servic			
	Students are able to independently deepen their acquir			
	 Students are able to acquire additional knowledge a lectures. 	na to recapitulate poony understood conte	int e.g. by using the	video recordings of
	lectures.			
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Specialisation	on Mechanical Engineering, Focus Energy S	ystems: Compulsory	
Curricula	General Engineering Science (German program): Specialisation	on Mechanical Engineering, Focus Aircraft S	ystems Engineering: (Compulsory
	General Engineering Science (German program): Specialisation	on Mechanical Engineering, Focus Materials	in Engineering Scien	ices: Compulsory
	General Engineering Science (German program): Specialisation	on Mechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (German program): Specialisation	on Mechanical Engineering, Focus Product [evelopment and Pro	duction: Compulsory
	General Engineering Science (German program): Specialisation	on Mechanical Engineering, Focus Theoretic	al Mechanical Engine	eering: Compulsory
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, Foc	us Aircraft Systems E	ngineering: Compuls
	General Engineering Science (German program, 7 semeste		-	
	Compulsory			0 0 0
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, Foc	us Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semester	1 G G,		
	Compulsory			
	General Engineering Science (German program, 7 semeste	r): Specialisation Mechanical Engineering,	Focus Theoretical N	Mechanical Engineer
	Compulsory			
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, Foc	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester):			
	General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program): Specialisatio			Compulsory
	General Engineering Science (English program): Specialisatio			
				,,
	General Engineering Science (English program): Specialisatio	J J		
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio	n Mechanical Engineering, Focus Product D	evelopment and Proc	duction: Compulsorv
	General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio	n Mechanical Engineering, Focus Theoretica	al Mechanical Engine	ering: Compulsory
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio General Engineering Science (English program, 7 semester): S	n Mechanical Engineering, Focus Theoretica Specialisation Mechanical Engineering, Focu	al Mechanical Engine us Aircraft Systems Er	ering: Compulsory
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester	n Mechanical Engineering, Focus Theoretica Specialisation Mechanical Engineering, Focu	al Mechanical Engine us Aircraft Systems Er	ering: Compulsory
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester Compulsory	n Mechanical Engineering, Focus Theoretica Specialisation Mechanical Engineering, Focu or): Specialisation Mechanical Engineering	al Mechanical Engine us Aircraft Systems Er , Focus Materials in	ering: Compulsory ngineering: Compulso Engineering Science
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester Compulsory General Engineering Science (English program, 7 semester): S	n Mechanical Engineering, Focus Theoretica Specialisation Mechanical Engineering, Focu rr): Specialisation Mechanical Engineering Specialisation Mechanical Engineering, Focu	al Mechanical Engine us Aircraft Systems Er , Focus Materials in us Mechatronics: Corr	ering: Compulsory ngineering: Compulso Engineering Science npulsory
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester Compulsory General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S	n Mechanical Engineering, Focus Theoretica Specialisation Mechanical Engineering, Focu rr): Specialisation Mechanical Engineering Specialisation Mechanical Engineering, Focu	al Mechanical Engine us Aircraft Systems Er , Focus Materials in us Mechatronics: Corr	ering: Compulsory ngineering: Compulso Engineering Science npulsory
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester Compulsory General Engineering Science (English program, 7 semester): S	n Mechanical Engineering, Focus Theoretica Specialisation Mechanical Engineering, Focu rr): Specialisation Mechanical Engineering Specialisation Mechanical Engineering, Focu): Specialisation Mechanical Engineering, F	al Mechanical Engine us Aircraft Systems Er , Focus Materials in us Mechatronics: Conr Focus Product Devel	ering: Compulsory ngineering: Compulso n Engineering Science npulsory opment and Product



Compulsory

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

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

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



Course L0262: Advanced Mechanic	al Engineering Design I
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	Advanced Mechanical Engineering Design I & II
	Lecture
	Fundamentals of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	• Seals
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank drives
	 Sliding bearings
	Elements of fluidics
	Exercise
	Calculation methods of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Clutches & brakes
	• Belt & chain drives
	Gear drives
	• Epicyclic gears
	Crank gears
	• Sliding bearings
	Calculations of hydrostatic systems (fluidics)
Literature	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	 Bubber, raschenduch die Maschinenbau, Grote, KH., Feldhasen, J. (1989), Sphinger-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 Konstruktionselemente, Steinmiper, W., Koper, K., Springer Verlag, aktuelle Kullage. Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.
	 Emunrung in die Div-Normen, Nein, w., reubner-Verlag. Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.
	 Konstruktionstenre, Fain, G., Beiz, W., Spinger-Verlag, aktuelle Auflage. Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage.
	 Maschinenelemente 1-2, Schech, B., Fearson Verlag, actuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage.
	 Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Bücher zu speziellen Themen

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



ourses	
tle	Typ Hrs/wk CP
Ivanced Mechanical Design Project (L02	66) 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.
Skills	After passing the module, students are able to:
	analyze complex tasks and develop principle solutions using sketches,
	convert principle solutions into a detailed design,
	use methods to design and solve engineering design tasks systematically and solution-oriented,
	 create a technical documentation including all necessary technical drawings to understand the functions of the system, document calculations of selected machine elements clearly and in detail.
Personal Competence	
Social Competence	After passing the module, students are able to:
	 present and discuss solutions and technical drawings within groups,
	 reflect the own results in the work groups of the course
Autonomy	After passing the module, students are able to:
	independently solve complex design projects, while motivating themselves, acquiring necessary knowledge and selecting appropriate meth
	to independently solve problems.
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Credit points	6
Examination Examination duration and scale	Written exam
	180
Assignment for the Following Curricula	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulso
Guincula	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: Compu
	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 Theoretical Mechanical Engine
	Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsor
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Comput
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Produ
	Compulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engine
	Compulsory



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



Courses				
Title		Тур	Hrs/wk	CP
Simulation and Design of Mechatronic Systems (L1822)		Lecture	2	2
Simulation and Design of Mechatronic Sys	tems (L1824)	Laboratory	1	2
Simulation and Design of Mechatronic Sys	tems (L1823)	Recitation Section (large)	1	2
Module Responsible	Prof. Uwe Weltin			
Admission Requirements	None			
Recommended Previous	Fundatmentals of mechanics, control theory and electr	ical engineering		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	ne following learning results		
Professional Competence				
Knowledge	Students are able to describe methods and calculation	ns for design, modeling, simulation and optimization	of mechatronic syster	ns.
0.11				
Skills	11,5 6	nodeling of mechatronic systems. They can ident	ity, simulate and des	sign simple systems ar
	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 evalua	te their own knowledge level and define a further co	uree of study	
Workload in Hours			and of stady.	
Credit points	Independent Study Time 124, Study Time in Lecture 56			
Examination	6 Written exam			
Examination duration and scale	90 min			
		ciplication Machanical Engineering Engine Machan		
Assignment for the Following Curricula	General Engineering Science (German program): Spe General Engineering Science (German program): Spe	• •		Compulson
Curricula	General Engineering Science (German program): Spe			
	General Engineering Science (German program, 7 se		, e	
	General Engineering Science (German program, 7 set	, ,		
	General Engineering Science (German program, 7		-	
	Elective Compulsory		,,	3
	General Engineering Science (English program): Spe	cialisation Mechanical Engineering, Focus Aircraft S	systems Engineering:	Compulsory
	General Engineering Science (English program): Spe	cialisation Mechanical Engineering, Focus Mechatro	onics: Compulsory	
	General Engineering Science (English program): Spe	cialisation Mechanical Engineering, Focus Theoretic	cal Mechanical Engine	ering: Compulsory
	General Engineering Science (English program, 7 ser	nester): Specialisation Mechanical Engineering, Fo	cus Mechatronics: Cor	npulsory
	General Engineering Science (English program, 7 ser	nester): Specialisation Mechanical Engineering, Fo	cus Aircraft Systems E	ngineering: Compulsor
	General Engineering Science (English program, 7	semester): Specialisation Mechanical Engineering	, Focus Theoretical	Mechanical Engineerin
	Elective Compulsory			
	Mechanical Engineering: Specialisation Aircraft System	ns Engineering: Compulsory		
	Mechanical Engineering: Specialisation Mechatronics	: Compulsory		
	Mechanical Engineering: Specialisation Theoretical M	echanical Engineering: Compulsory		
	Mechatronics: Core qualification: Compulsory			

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



Course L1824: Simulation and Desig	ourse 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 Desig	gn of Mechatronic Systems		
Тур	Recitation Section (large)		
Hrs/wk	1		
CP	2		
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14		
Lecturer	Prof. Uwe Weltin		
Language	DE		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		



Courses				
Title		Тур	Hrs/wk	CP
CAE-Team Project (L0271)		Problem-based Learning	2	2
Development of Lightweight Design Production	cts (L0270)	Lecture	2	2
Integrated Product Development I (L0269)	Dest Distant/varian	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 th	e following learning results		
Professional Competence				
Knowledge	After completing the module, students are capable of:			
	 explaining the functional principle of 3D-CAD-S 	ystems, PDM- and FEM-Systems		
	 describing the interaction of the different CAE-S 			
Skills				
on the				
	After completing the module, students are able to:			
	evaluate different CAD- and PDM-Systems with		ification schemes and	product structuring
	 design an exemplary product using CAD-,PDM- 	and/or FEM-Systems with shared workload		
Personal Competence				
Social Competence	After completing the module, students are able to:			
eesial eempetenee				
	To develop a project plan and allocate work app		o discussions	
	 Present project results as a team for instance in 	a presentation		
Autonomy	Students are capable of:			
	 independently adapt to a CAE-Tool and comple 	te 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): Spec	cialisation Mechanical Engineering. Focus Aircraft	Systems Engineering:	Compulsory
Curricula	General Engineering Science (German program): Spec			
	General Engineering Science (German program, 7 sem	nester): Specialisation Mechanical Engineering, Fo	ocus Aircraft Systems E	ngineering: Compulso
	General Engineering Science (German program, 7 se	emester): Specialisation Mechanical Engineering	, Focus Product Deve	lopment and Production
	Compulsory			
	General Engineering Science (English program): Spec	ialisation Mechanical Engineering, Focus Aircraft	Systems Engineering: (Compulsory
	General Engineering Science (English program): Spec	ialisation Mechanical Engineering, Focus Product	Development and Proc	duction: Compulsory
	General Engineering Science (English program, 7 sem	,	-	
	General Engineering Science (English program, 7 se	emester): Specialisation Mechanical Engineering	Focus Product Devel	lopment and Production
	Compulsory			
	Mechanical Engineering: Specialisation Product Develo			
	Mechanical Engineering: Specialisation Aircraft System	is Engineering: Compulsory		



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

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

Course L0269: Integrated Product D	Course L0269: Integrated Product Development I	
Тур	Lecture	
Hrs/wk		
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause	
Language	DE	
Cycle	SoSe	
Content	 Introduction to Integrated Product Development 3D CAD -Systems and CAD interfaces Administration of part lists / PDM systems PDM in different industries Selection of CAD-/PDM Systems Simulation Construction methods Design for X 	
Literature	 Ehrlenspiel, K.: Integrierte Produktentwicklung, München, Carl Hanser Verlag Lee, K.: Principles of CAD / CAM / CAE Systems, Addison Wesles Schichtel, M.: Produktdatenmodellierung in der Praxis, München, Carl Hanser Verlag Anderl, R.: CAD Schnittstellen, München, Carl Hanser Verlag Spur, G., Krause, F.: Das virtuelle Produkt, München, Carl Hanser Verlag 	



Module M0767: Aeronautic	al Svetame			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Aircraft Systems (L0741))	Lecture	2	2
Fundamentals of Aircraft Systems (L0742))	Recitation Section (small)	1	1
Air Transportation Systems (L0591)		Lecture	2	2
Air Transportation Systems (L0816)		Recitation Section (large)	1	1
Module Responsible	Prof. Frank Thielecke			
Admission Requirements	none			
Recommended Previous	Basics of mathematics, mechanics and thermodyna	mics		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
Knowledge	Students get a basic understanding of the structure and design of an aircraft, as well as an overview of the systems inside an aircraft. In addition, a basic			
	knowledge of the relationchips, the key parameters, roles and ways of working in different subsystems in the air transport is acquired.			uired.
Skills	Due to the learned cross-system thinking students can gain a deeper understanding of different system concepts and their technical system			
	implementation. In addition, they can apply the learned methods for the design and assessment of subsystems of the air transportation system			nsportation system in the
	context of the overall system.			
Personal Competence				
Social Competence	Students are made aware of interdisciplinary communication in groups.			
Autonomy	Students are able to independently analyze differen	t system 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): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory			
Curricula	General Engineering Science (German program, 7	semester): Specialisation Mechanical Engineering, F	ocus Aircraft Systems E	Engineering: Compulsory
	General Engineering Science (English program): S	pecialisation Mechanical Engineering, Focus Aircraft	Systems Engineering:	Compulsory
	General Engineering Science (English program, 7 s	semester): Specialisation Mechanical Engineering, Fo	cus Aircraft Systems E	ngineering: Compulsory
	Logistics and Mobility: Specialisation Logistics and	Mobility: Elective Compulsory		
	Mechanical Engineering: Specialisation Aircraft Sys			
	J - J	5 - 5		

Course L0741: Fundamentals of Air	craft 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

ourse L0742: Fundamentals of Aircraft Systems		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Frank Thielecke	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	



Course L0591: Air Transportation Systems		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Volker Gollnick	
Language	DE	
Cycle	SoSe	
Content	 Air transport as part of the global transportation system Legal basis of air transportation Safety and security aspects Aircraft basics The role of the aircraft amnufacturer The role of the aircraft operator Airport operation The principles of air traffic management Environmental aspects of air transportation Future perspectives of air transport 	
Literature	 H. Mensen: "Handbuch der Luftfahrt", Springer-Verlag, 2003 K. Hünecke: "Die Technik des modernen Verkehrsflugzeugs", Motorbuch-Verlag, 2000, ISBN 3-613-01895-0 I. Moir, A. Seabridge: "Aircraft Systems", AIAA Education Series, 2001, ISBN 1-56347-506-5 D.P. Raymer: "Aircraft Design - A Conceptual Approach", AIAA Education Series, 2006, ISBN 1-56347-281-3 N. Ashford: "Airport Operations", McGraw-Hill, 1997, ISBN0-07-003077-4 P. Maurer: "Luftverkehrsmanagement", Oldenbourg-Verlag, ISBN 3-486-27422-8 H. Mensen: "Moderne Flugsicherung", Springer-Verlag, 2004, ISBN 3-540-20581-0 	

Course L0816: Air Transportation Systems		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Volker Gollnick	
Language	DE	
Cycle	SoSe	
Content	Practical exercises to understand	
Literature	aircraft movement in wind conditions aircraft performance analyses radio navigation prinicples Objective: Understanding and application of principle methods to practical aviation problems Hünnecke: Das moderne Verkehrsflugzeug von heute Flühr: Avionik und Flugsicherungstechnik	



Focus Materials in Engineering Sciences

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

Module M0597: Advanced	Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	CP
Advanced Mechanical Engineering Design	n II (L0264)	Lecture	2	2
Advanced Mechanical Engineering Design	n II (L0265)	Recitation Section (large)	2	1
Advanced Mechanical Engineering Design	n I (L0262)	Lecture	2	2
Advanced Mechanical Engineering Design	n I (L0263)	Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	 Eventementals of Machanical Expiremental Design 			
Knowledge	 Fundamentals of Mechanical Engineering Design Machanica 			
	Mechanics Evadementals of Metarials Calence			
	Fundamentals of Materials Science Production Engineering			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the follow	wing learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
-				
	 explain complex working principles and functions of m 			
	explain requirements, selection criteria, application sc	enarios and practical examples of complex m	achine elements,	
	 indicate the background of dimensioning calculations. 			
Skille	After passing the module, students are able to:			
OKIIS				
	accomplish dimensioning calculations of covered mac	hine elements,		
	transfer knowledge learned in the module to new requ	irements and tasks (problem solving skills),		
	recognize the content of technical drawings and scher	natic sketches,		
	 evaluate complex designs, technically. 			
Porconal Compotence				
Personal Competence				
Social Competence	Students are able to discuss technical information in the second se	e lecture supported by activating methods.		
Autonomy	 Students are able to independently deepen their acqu 	ired knowledge in exercises.		
	 Students are able to acquire additional knowledge 		nt e.a. by using the	video recordings of t
	lectures.			J
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Specialisat	on Mechanical Engineering, Focus Energy S	ystems: Compulsory	
Curricula	General Engineering Science (German program): Specialisat	on Mechanical Engineering, Focus Aircraft S	ystems Engineering:	Compulsory
	General Engineering Science (German program): Specialisat	on Mechanical Engineering, Focus Materials	in Engineering Scier	nces: Compulsory
	General Engineering Science (German program): Specialisat	on Mechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (German program): Specialisat	on Mechanical Engineering, Focus Product D	evelopment and Pro	duction: Compulsory
	General Engineering Science (German program): Specialisat	on Mechanical Engineering, Focus Theoretic	al Mechanical Engine	eering: Compulsory
	General Engineering Science (German program, 7 semester)	Specialisation Mechanical Engineering, Foc	us Aircraft Systems E	ngineering: Compulso
	General Engineering Science (German program, 7 semes	ter): Specialisation Mechanical Engineering	, Focus Materials ir	n Engineering Scienc
	Compulsory			
	General Engineering Science (German program, 7 semester)	Specialisation Mechanical Engineering, Foc	us Mechatronics: Cor	mpulsory
	General Engineering Science (German program, 7 semester	r): Specialisation Mechanical Engineering, I	Focus Product Devel	lopment and Producti
	Compulsory			
	General Engineering Science (German program, 7 semest	er): Specialisation Mechanical Engineering,	Focus Theoretical M	Mechanical Engineeri
	Compulsory			
	General Engineering Science (German program, 7 semester)	Specialisation Mechanical Engineering, Foc	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester)	Specialisation Mechanical Engineering, Foc	us Energy Systems: (Compulsory
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Energy Sy	stems: Compulsory	
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Aircraft Sy	stems Engineering: (Compulsory
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Materials	in Engineering Scien	ces: Compulsory
	General Engineering Science (English program): Specialisati	on Mechanical Engineering, Focus Mechatror	nics: Compulsory	
	General Engineering Science (English program): Specialisation			duction: Compulsory
	General Engineering Science (English program): Specialisation	• •		
	General Engineering Science (English program, 7 semester):		-	
	General Engineering Science (English program, 7 semest	er): Specialisation Mechanical Endineering		1 Engineerina Scienc
		er): Specialisation Mechanical Engineering		n Engineering Scienc
	Compulsory			
	Compulsory General Engineering Science (English program, 7 semester):	Specialisation Mechanical Engineering, Focu	us Mechatronics: Con	npulsory
	Compulsory	Specialisation Mechanical Engineering, Focu	us Mechatronics: Con	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. Computsory

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

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



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

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



Module M0988: Structural I	Materials			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Mechanical Properties o	f Materials (L1090)	Lecture	2	3
Welding Technology (L1123)		Lecture	3	3
Module Responsible	Prof. Claus Emmelmann			
Admission Requirements	None			
Recommended Previous	Fundamentals of Materials Science			
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ed the following learning results		
Professional Competence				
Knowledge	The students get to know the principles that are re-	esponsible for the mechanical behaviour of metals.	They acquire basic knowl	egde in modelling of the
	materials behaviour. Furthermore, the students lea	arn about the behaviour of metals under static and	dynamic loads. The stude	nts get to know the mos
	important welding technologies and the correspon	ding systems. They learn about the influence of well	ding on the materials and o	design.
Skills	The students know the mechanical properties of	metals and the underlying principles. They are ab	le to name the influencing	n factors on the welding
	behaviour of steel materials.			
		ccording to the desired mechaincal properties and		-
	÷ ,	ique and system components for a defined applicat	ion. They are able to dime	ension weld joints withir
	design tasks.			
Personal Competence				
Social Competence	none			
Autonomy	none			
Workload in Hours	Independent Study Time 110, Study Time in Lecture	re 70		
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program):	Specialisation Mechanical Engineering, Focus Mate	erials in Engineering Scien	ces: Compulsory
Curricula	General Engineering Science (German program	n, 7 semester): Specialisation Mechanical Engine	ering, Focus Materials in	Engineering Sciences
	Compulsory			
	General Engineering Science (English program): S	Specialisation Mechanical Engineering, Focus Mate	rials in Engineering Scien	ces: Compulsory
	General Engineering Science (English program	, 7 semester): Specialisation Mechanical Engine	ering, Focus Materials in	Engineering Sciences
	Compulsory			
	Mechanical Engineering: Specialisation Materials	in Engineering Sciences: Compulsory		

Course L1090: Fundamentals of Mechanical Properties of Materials		
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Norbert Huber, Dr. Erica Lilleodden	
Language	EN	
Cycle	SoSe	
Content	1. Introduction and overview	
	2. Bonding and crystallography, stress, strain, linear elasticity	
	3. Plasticity of metallic materials	
	4. Dislocations: Structure, stress, strain, strain energy	
	5. Dislocations: Motion and forces	
	6. Partial dislocations, dislocation interactions, jogs and kinks	
	7. Strengthening mechanisms	
	8. Introduction to modelling of materials behaviour, classification of	
	phenomena	
	9. Linear and nonlinear elasticity	
	10. Plasticity, tensile loading, cyclic loading	
	11. Viscoelasticity, effects of loading history, creep, relaxation	
	12. Viscoplasticity, overstress, rate sensitivity of metallic materials	
	13. Identification of material parameters	
Literature	Hull and Bacon: Introduction to Dislocations (1984)	
	G. Gottstein: Physik. Grundlagen der Materialk. (2001)	
	Al Unite and Contract on Material Manager (1990)	
	N.Huber: Scriptum "Materialtheorie" Uni Karlsruhe (1998)	
	P. Haupt: Cont. Mechanics and Theory of Materials (2002)	
L	1	



Course L1123: Welding Technology		
Тур	Lecture	
Hrs/wk	3	
CP	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Claus Emmelmann, Prof. Karl-Ulrich Kainer	
Language	DE	
Cycle	WiSe	
Content	- phase transitions, phase diagrams and thermal activated processes	
	- fundamentals of steels, heat treatment applications for steels and time temperature transformation diagrams	
	- properties of weldable carbon and fine grained steels	
	- properties of weldable low- and high-alloy steels, corrosion resistant steels and high-strength steels	
	- structure and properties of non-ferrite metals (aluminum, titanium)	
	- NDT/DT Methods for materials and welds	
	- gas fusion welding, fundamentals of electric arc welding technologies	
	- structure and influence parameters for the welded joint	
	- submerged arc welding/tungsten inert gas welding/inert gas metal arc welding (MIG)/active gas metal arc welding (MAG)/Plasma Welding	
	- resistance welding/ polymer welding/ hybrid-welding	
	- deposition welding	
	- electron beam welding/ laser beam welding	
	- weld joint designs and declarations	
	- computation methods for weld joint dimensioning	
Literature	Schulze, G.: Die Metallurgie des Schweißens, 4. Aufl., Berlin 2010 Strassburg, F.W. und Wehner H.: Schweißen nichtrostender Stähle, 4. Aufl.	
	Düsseldorf, 2009 Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 1: Schweiß- und Schneidtechnologien, 3. Aufl., Berlin 2006.	
	Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 2: Verhalten der Werkstoffe beim Schweißen, 3. Aufl., Berlin 2005.	
	Dilthey, U.: Schweißtechnische Fertigungsverfahren, Bd. 3: Gestaltung und Festigkeit von Schweißkonstruktionen, 2. Aufl., Berlin 2002.	



Module M0662: Numerical	Mathematics I			
Module M0662: Numerical				
Courses				
litle		Тур	Hrs/wk	CP
Numerical Mathematics I (L0417)		Lecture	2	3
Numerical Mathematics I (L0418)		Recitation Section (small)	2	3
Module Responsible	Prof. Sabine Le Borne			
Admission Requirements Recommended Previous	None			
Knowledge	 Mathematik I + II for Engineering Students (german or e basic MATLAB knowledge 	nglish) or Analysis & Linear Algebra I + II f	or Technomathematicia	Ins
Educational Objectives	After taking part successfully, students have reached the follow	ing learning results		
Professional Competence				
Knowledge	Students are able to			
	 name numerical methods for interpolation, integration explain their core ideas, repeat convergence statements for the numerical method explain aspects for the practical execution of numerical 	nds,		finding problems and
Skills	Students are able to			
	 implement, apply and compare numerical methods usir justify the convergence behaviour of numerical methods select and execute a suitable solution approach for a git 	s with respect to the problem and solution a	algorithm,	
Personal Competence				
Social Competence	Students are able to			
Autonomy	 work together in heterogeneously composed teams (i.e., teams from different study programs and background knowledge), explain theoret foundations and support each other with practical aspects regarding the implementation of algorithms. Students are capable to assess whether the supporting theoretical and practical excercises are better solved individually or in a team, 			
	 to assess their individual progess and, if necessary, to a 	sk questions and seek help.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 minutes			
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula				
	General Engineering Science (German program): Specialisatio		Is in Engineering Scien	ces: Compulsory
	General Engineering Science (German program): Specialisation General Engineering Science (German program, 7 semester):		con	
	General Engineering Science (German program, 7 semester).			Engineering Scienc
	Compulsory		ng, roodo matonalo m	Linginooning colorio
	General Engineering Science (German program, 7 semester):	Specialisation Biomedical Engineering: Co	ompulsory	
	General Engineering Science (German program, 7 semester):	Specialisation Mechanical Engineering, Fo	ocus Biomechanics: Co	mpulsory
	Bioprocess Engineering: Specialisation A - General Bioprocess	s Engineering: Elective Compulsory		
	Computer Science: Specialisation Computational Mathematics	: Elective Compulsory		
	Electrical Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program): Specialisatio	n Computer Science: Compulsory		
	General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program): Specialisatio			
		n Mechanical Engineering, Focus Material		ces: Compulsory
			2012/	
	General Engineering Science (English program, 7 semester): S			
	General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semeste			Engineering Scienc
	General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semeste Compulsory	r): Specialisation Mechanical Engineerir	ng, Focus Materials in	Engineering Scienc
	General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester Compulsory General Engineering Science (English program, 7 semester): S	r): Specialisation Mechanical Engineerin Specialisation Biomedical Engineering: Co	ng, Focus Materials in mpulsory	
	General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semeste Compulsory	r): Specialisation Mechanical Engineerin Specialisation Biomedical Engineering: Co Specialisation Mechanical Engineering, Fo	ng, Focus Materials in mpulsory	



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	



ourses				
ïtle		Тур	Hrs/wk	CP
Companion Lecture for Materials Science	Laboratory (L1088)	Lecture	2	2
Material Science Laboratory (L1235)		Laboratory Course	4	4
Module Responsible	Prof. Bodo Fiedler			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	Students are able to give a summary of the technical	details of experiments in the area of materials s	ciences and illustrate resp	ective relationships. T
	are capable of describing and communicating relev	ant problems and questions using appropriate	e technical language. The	y can explain the typ
	process of solving practical problems and present rela	ated results.		
Skills	The students can transfer their fundemental knowled	dre on motorial asigneds to the process of colu	ing practical problems. The	av identify and average
Skills		•	ing practical problems. The	ey identity and overco
	typical problems during the realization of experiments	s in the context of material sciences.		
Personal Competence				
Social Competence	Students are able to cooperate in small groups in order to conduct experiments in the context of materials sciences. They are able to effectively preser			
	and explain their results alone or in groups in front of	a qualified audience.		
Autonomy	Students are capable of solving problems in the con	ntext of materials sciences using provided liter	ature. They are able to fill	nans in as well as ex
, leteneny	their knowledge using the literature and other sources	• •		gape in de neir de ex
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): Spo	ecialisation Mechanical Engineering, Focus Ma	terials in Engineering Scie	nces: Compulsory
Curricula	General Engineering Science (German program): Spo	ecialisation Mechanical Engineering, Focus Pro	duct Development and Pro	duction: Compulsory
	General Engineering Science (German program, 7	7 semester): Specialisation Mechanical Engin	eering, Focus Materials in	n Engineering Sciend
	Compulsory			
	General Engineering Science (English program): Spe	ecialisation Mechanical Engineering, Focus Mat	erials in Engineering Scier	ices: Compulsory
	General Engineering Science (English program): Spe	ecialisation Mechanical Engineering, Focus Pro	duct Development and Pro	duction: Compulsory
	General Engineering Science (English program, 7	semester): Specialisation Mechanical Engin	eering, Focus Materials in	n Engineering Sciend
	Compulsory			
	Mechanical Engineering: Specialisation Product Deve	elopment and Production: Compulsory		
	Mechanical Engineering: Specialisation Materials in I	Engineering Sciences: Compulsory		
	Product Development, Materials and Production: Tech	haiaal Camplementary Course Core Studios: El	active Compulsory	

Sourse L1088: Companion Lecture for Materials Science Laboratory		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Patrick Huber	
Language	DE	
Cycle	WiSe	
Content	Physico-chemical backgrounds and fundamental experimental principles with regard to the following experiments, the topics to be addressed are	
	indicated in brackets for each experiment:	
	1. Phase diagrams, heat treatment, hardness measurements (thermodynamics, elastic properties of solids)	
	2. notch impact test (elastic properties of solids)	
	3. Processes during the solidifaction of metals (thermodynamics and kinetics of solid-liquid phase transitions)	
	4. tensile test (elastic properties of solids)	
	5. Identificiation of polymers (polymer physics)	
	6. fiber-reinforced polymers (physical principles of composite materials)	
	7. Production and microstructure of ceramic materials (physico-chemical principles of ceramics)	
	8. Mechanical properties of ceramic materials (elastic properties of solids and composite materials)	
Literature	William D. Callister und David G. Rethwisch, Materialwissenschaften und Werkstofftechnik, Wiley&Sons, Asia (2011)	
	William D. Callister, Materials Science and Technology, Wiley& Sons, Inc. (2007)	



Course L1235: Material Science Lab	Course L1235: Material Science Laboratory	
Тур	Laboratory Course	
Hrs/wk	4	
CP	4	
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56	
Lecturer	Prof. Bodo Fiedler, Prof. Stefan Müller, Prof. Patrick Huber, Prof. Gerold Schneider, Prof. Jörg Weißmüller	
Language	DE	
Cycle	WiSe	
Content	8 Versuche:	
	Zustandsdiagramm, Wärmebehandlung, Härtemessung	
	Kerbschlagbiegeversuch	
	Vorgänge bei der Erstarrung von Metallen	
	Zugversuch	
	Identifizierung von Kunststoffen	
	Faserverstärkte Kunststoffe	
	Herstellung und Gefüge keramischer Werkstoffe	
	Mechanisches Verhalten keramischer Werkstoffe	
Literature	Vorlesungsunterlagen Grundlagen der Werkstoffwissenschaft I & II	



Module M1005: Enhanced	Fundamentals of Materials Science			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Metallic Materials (L1086)	Lecture	2	3
Fundamentals of Ceramic and Polymer Ma	aterials (L1233)	Lecture	2	2
Fundamentals of Ceramic and Polymer Ma	aterials (L1234)	Recitation Section (large)	1	1
Module Responsible	Prof. Gerold Schneider			
Admission Requirements	None			
Recommended Previous	Module "Fundamentals of Materials Science"			
Knowledge	Madula "Meteriala Caisana Lakavatana"			
	Module "Materials Science Laboratory"			
	Module "Advanced Materials"			
Educational Objectives Professional Competence	After taking part successfully, students have reached the following learn	ing results		
Knowledge	The students are able to give an enhanced evention over the following	tabias		
Knowledge	The students are able to give an enhanced overview over the following in metals, polymers and ceramics: Atomic bonds, crystal and amorphy		acc transport m	icrostructure and phase
	diagrams. They are capable to explain the corresponding technical term			icrostructure and phase
	diagrams. They are capable to explain the corresponding technical term	15.		
	<u>_</u>			
Skills	The students are able to apply the appropriate physical and chemical m	ethods for the above mentioned subject	S.	
Personal Competence				
Social Competence				
Autonomy	The students are capable to understand independently the structure a	and propeties of ceramics, metals and r	olymers. They s	hould 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): Specialisation Mecha	nical Engineering, Focus Materials in Er	ngineering Scien	ces: Compulsory
Curricula	General Engineering Science (German program, 7 semester): Spec			
	Compulsory			
	General Engineering Science (German program, 7 semester): Specia	lisation Mechanical Engineering, Focu	s Product Develo	opment and Production
	Compulsory			
	General Engineering Science (English program): Specialisation Mecha	nical Engineering, Focus Materials in En	gineering Scienc	es: Compulsory
	General Engineering Science (English program, 7 semester): Spec	alisation Mechanical Engineering, Fo	cus Materials in	Engineering Sciences
	Compulsory			
	General Engineering Science (English program, 7 semester): Specia	lisation Mechanical Engineering, Focus	s Product Develo	opment and Production
	Compulsory			
	Mechanical Engineering: Specialisation Materials in Engineering Scien	ces: Compulsory		
	Technomathematics: Specialisation III. Engineering Science: Elective C	ompulsory		
	Technomathematics: Core qualification: Elective Compulsory			

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		



Course 1233: Fundamentals of Co	ramic and Polymer Materials
Course L1233: Fundamentals of Ce	Lecture
Hrs/wk	
CP	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Gerold Schneider, Prof. Bodo Fiedler
Language	DE/EN
Cycle	SoSe
Content	1. Einführung
	Natürliche "Keramiken" – Steine
	"Künstliche" Keramik – vom Porzellan bis zur Hochleistungskeramik Anwendungen von Hochleistungskeramik
	2. Pulvorberetellung
	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
	Ferroelektische Keramiken
	Piezo-, ferroelektrische Materialeigenschaften
	Anwendungen
	Keramische Ionenleiter
	Ionische Leitfähigkeit
	Dotiertes Zirkonoxid in der Brennstoffzelle und Lambdasonde
Literature	D R H Jones, Michael F. Ashby, Engineering Materials 1, An Introduction to Properties, Applications and Design, Elesevier
	D.W. Richerson, Modern Ceramic Engineering, Marcel Decker, New York, 1992
	W.D. Kingery, Introduction to Ceramics, John Wiley & Sons, New York, 1975
	D.J. Green, An introduction to the mechanical properties of ceramics", Cambridge University Press, 1998
	D. Munz, T. Fett, Ceramics, Springer, 2001
	Polymerwerkstoffe
	Struktur und mechanische Eigenschaften G.W.Ehrenstein;
	Hanser Verlag; ISBN 3-446-12478-0; ca. 20 €
	Kunststoffphysik
	W.Retting, H.M.Laun; Hanser Verlag; ISBN 3446162356; ca. 25 €
	Werkstoffkunde Kunststoffe
	G.Menges; Hanser Verlag; ISBN 3-446-15612-7; ca. 25 €
	Kunststoff-Kompendium
	A.Frank, K. Biederbick; Vogel Buchverlag; ISBN 3-8023-0135-8; ca.30 €



Course L1234: Fundamentals of Ce	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	



Focus Mechatronics

Mechatronics or an economical orie	Mechanical Engineering Design			
Module M0397. Advanced				
Courses				
Title .		Тур	Hrs/wk	CP
dvanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design Advanced Mechanical Engineering Design		Recitation Section (large) Lecture	2	1
Advanced Mechanical Engineering Design		Recitation Section (large)	2	1
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
	None			
Recommended Previous Knowledge	Fundamentals of Mechanical Engineering Design			
Kilowiedge	Mechanics			
	 Fundamentals of Materials Science 			
	Production Engineering			
Educational Ohiostivas				
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:			
	 explain complex working principles and functions of man 	chine elements and of basic elements of flui	idics,	
	 explain requirements, selection criteria, application scer 	narios and practical examples of complex m	achine elements,	
	 indicate the background of dimensioning calculations. 			
Skills	After passing the module, students are able to:			
	 accomplish dimensioning calculations of covered maching 	ine elements,		
	 transfer knowledge learned in the module to new require 			
	 recognize the content of technical drawings and schema 			
	 evaluate complex designs, technically. 			
Personal Competence				
Social Competence	 Students are able to discuss technical information in the 	lecture supported by activating methods		
		recture supported by activating methods.		
Autonomy				
	Students are able to independently deepen their acquire			
	 Students are able to acquire additional knowledge and the students are able to acquire additional knowledge are students. 	id to recapitulate poorly understood conte	ent e.g. by using the	video recordings of
	lectures.			
Workload in Hours	Independent Study Time 68, Study Time in Lecture 112			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Specialisatio	n Mechanical Engineering, Focus Energy S	vstems: Compulsory	
Curricula	General Engineering Science (German program): Specialisatio			Compulsory
	General Engineering Science (German program): Specialisatio			
	General Engineering Science (German program): Specialisatio			·····
	General Engineering Science (German program): Specialisatio			duction: Compulsory
	General Engineering Science (German program): Specialisatio		-	
	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (German program, 7 semester).		3	0 0 1
	Compulsory	The open and a second mean and a second		
	General Engineering Science (German program, 7 semester): S	Specialisation Mechanical Engineering For	us Mechatronics: Co	mpulsory
	General Engineering Science (German program, 7 semester)			
	Compulsory			
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering	Focus Theoretical	Mechanical Engineeri
	Compulsory	,		
	General Engineering Science (German program, 7 semester): S	Specialisation Mechanical Engineering For	us Biomechanics: Co	mpulsory
	General Engineering Science (German program, 7 semester): S			
	General Engineering Science (English program): Specialization			Compulsory
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation	,	in Engineering Scien	ces: Compulsorv
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	Mechanical Engineering, Focus Materials		ces: Compulsory
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	n Mechanical Engineering, Focus Materials n Mechanical Engineering, Focus Mechatron	nics: 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	n Mechanical Engineering, Focus Materials n Mechanical Engineering, Focus Mechatror n Mechanical Engineering, Focus Product D	nics: Compulsory vevelopment and Prov	duction: Compulsory
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation	n Mechanical Engineering, Focus Materials n Mechanical Engineering, Focus Mechatron n Mechanical Engineering, Focus Product D n Mechanical Engineering, Focus Theoretica	nics: Compulsory vevelopment and Prov al Mechanical Engine	duction: Compulsory eering: Compulsory
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): S	n Mechanical Engineering, Focus Materials n Mechanical Engineering, Focus Mechatron n Mechanical Engineering, Focus Product D n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focu	nics: Compulsory levelopment and Pro- al Mechanical Engine us Aircraft Systems E	duction: Compulsory pering: Compulsory ngineering: Compulso
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S	n Mechanical Engineering, Focus Materials n Mechanical Engineering, Focus Mechatron n Mechanical Engineering, Focus Product D n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focu	nics: Compulsory levelopment and Pro- al Mechanical Engine us Aircraft Systems E	duction: Compulsory pering: Compulsory ngineering: Compulso
	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) Compulsory	n Mechanical Engineering, Focus Materials n Mechanical Engineering, Focus Mechatron n Mechanical Engineering, Focus Product D n Mechanical Engineering, Focus Theoretic pecialisation Mechanical Engineering, Focu r): Specialisation Mechanical Engineering	nics: Compulsory levelopment and Pro- al Mechanical Engine us Aircraft Systems E I, Focus Materials ir	duction: Compulsory eering: Compulsory ngineering: Compulso n Engineering Science
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S	n Mechanical Engineering, Focus Materials n Mechanical Engineering, Focus Mechatron n Mechanical Engineering, Focus Product D n Mechanical Engineering, Focus Theoretic ipecialisation Mechanical Engineering, Focu r): Specialisation Mechanical Engineering pecialisation Mechanical Engineering, Focu	nics: Compulsory levelopment and Pro- al Mechanical Engine us Aircraft Systems Ei I, Focus Materials in us Mechatronics: Cor	duction: Compulsory bering: Compulsory ngineering: Compulso n Engineering Science 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 Mechanical Engineering, Focus Materials n Mechanical Engineering, Focus Mechatron n Mechanical Engineering, Focus Product D n Mechanical Engineering, Focus Theoretic ipecialisation Mechanical Engineering, Focu r): Specialisation Mechanical Engineering pecialisation Mechanical Engineering, Focu	nics: Compulsory levelopment and Pro- al Mechanical Engine us Aircraft Systems Ei I, Focus Materials in us Mechatronics: Cor	duction: Compulsory bering: Compulsory ngineering: Compulso n Engineering Science npulsory
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): S General Engineering Science (English program, 7 semester): S	n Mechanical Engineering, Focus Materials n Mechanical Engineering, Focus Mechatron n Mechanical Engineering, Focus Product D n Mechanical Engineering, Focus Theoretic: pecialisation Mechanical Engineering, Focu r): Specialisation Mechanical Engineering, Focu specialisation Mechanical Engineering, Focu	nics: Compulsory levelopment and Pro- al Mechanical Engine us Aircraft Systems El II, Focus Materials in us Mechatronics: Cor Focus Product Deve	duction: Compulsory beering: Compulsory ngineering: Compulson n Engineering Science npulsory lopment and Producti



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	
	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
	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.
	Sowie weitere Bücher zu speziellen Themen

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



Course L0262: Advanced Mechanic	al Engineering Design I	
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	WiSe	
Content	Advanced Mechanical Engineering Design I & II	
	Lecture	
	Fundamentals of the following machine elements:	
	Linear rolling bearings	
	Axes & shafts	
	• Seals	
	Clutches & brakes	
	Belt & chain drives	
	Gear drives	
	• Epicyclic gears	
	Crank drives	
	 Sliding bearings 	
	Elements of fluidics	
	Exercise	
	Calculation methods of the following machine elements:	
	Linear rolling bearings	
	Axes & shafts	
	Clutches & brakes Relie drives	
	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.	
	 Bubber, raschenduch die Maschinenbau, Globe, KH., Heinrisen, S. (Hisg.), Sphinger-Verlag, artuelle 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. 	
	 Konstruktionstenre, Fain, G., Beiz, W., Springer-Verlag, aktuelle Auflage. Maschinenelemente 1-2; Schlecht, B., Pearson Verlag, aktuelle Auflage. 	
	 Maschinenelemente 1-2; Schecht, B., Pearson Verlag, axtuelle 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



Courses				
Title		Тур	Hrs/wk	CP
Circuit Theory (L0566)		Lecture	3	4
Circuit Theory (L0567)		Recitation Section (small)	2	2
Module Responsible	Prof. Arne Jacob			
Admission Requirements	none			
Recommended Previous	Electrical Engineering I and II, Mathematics I and II			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge	Students are able to explain the basic methods for calculating			
	periodic signals. They know the methods for transient analysis		ency domain, and they	are able to explain th
	frequency behaviour and the synthesis of passive two-terminal-	circuits.		
01-11-	The students are able to calculate surrante and valuess in line		eleeben duitee bure	viadia aismala. Thau a
Skills	The students are able to calculate currents and voltages in line			
	able to calculate transients in electrical circuits in time and frequ analyse and to synthesize the frequency behaviour of passive to		respective transient ber	laviour. They are able
	analyse and to synthesize the nequency behaviour of passive to	vo-terminar-circuits.		
Personal Competence				
Social Competence	Students work on exercise tasks in small guided groups. They a	re encouraged to present and discuss the	ir results within the arou	n
oodal oompeterioe			in results within the grot	
Autonomy	The students are able to find out the required methods for solvi	ng the given practice problems. Possibilit	ies are given to test the	ir knowledae durina th
	lectures continuously by means of short-time tests. This allows			
	knowledge to other courses like Electrical Engineering I and Ma		,	,
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale				
Assignment for the Following	General Engineering Science (German program): Specialisation			
Curricula	General Engineering Science (German program): Specialisation			
	General Engineering Science (German program, 7 semester): S			npulsory
	General Engineering Science (German program, 7 semester): S	pecialisation Electrical Engineering: Com	pulsory	
	Electrical Engineering: Core qualification: Compulsory	Electrical Engineering: Compulser:		
	General Engineering Science (English program): Specialisation General Engineering Science (English program): Specialisation		onice: Compulsory	
	General Engineering Science (English program): Specialisation General Engineering Science (English program, 7 semester): Sp			nulsony
	General Engineering Science (English program, 7 semester). S			puloury
	Computational Science and Engineering: Specialisation Engine	0 0	Jaioury	
	Mechatronics: Core qualification: Compulsory			
	Technomathematics: Specialisation III. Engineering Science: Ele	ective Compulsory		
	Technomathematics: Specialisation III. Engineering Science: El			

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



Course L0566: Circuit Theory	
Тур	Lecture
Hrs/wk	3
CP	4
Workload in Hours	Independent Study Time 78, Study Time in Lecture 42
Lecturer	Prof. Arne Jacob
Language	DE
Cycle	WiSe
Content	- Circuit theorems
	- N-port circuits
	- Periodic excitation of linear circuits
	- Transient analysis in time domain
	- Transient analysis in frequency domain; Laplace Transform
	- Frequency behaviour of passive one-ports
Literature	- M. Albach, "Grundlagen der Elektrotechnik 1", Pearson Studium (2011)
Literature	
	- 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



-				
Courses				
Title		Тур	Hrs/wk	CP
Simulation and Design of Mechatronic Systems (L1822) Simulation and Design of Mechatronic Systems (L1824)		Lecture Laboratory	2	2
Simulation and Design of Mechatronic Sys		Recitation Section (large)	1	2
Module Responsible		rissiaatin coolitin (haigo)	•	-
Admission Requirements	None			
Recommended Previous	Fundatmentals of mechanics, control theory and elect	trical engineering		
Knowledge	and another of meenanies, control meery and cree	alour engineering		
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence	The making part buccession, sudents have reached			
Knowledge	Students are able to describe methods and calculatio	ns for design 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 a
	implement those in laboratory conditions.			
Personal Competence				
	Students are able to work goal-oriented in small mixe	d groups and present results to target groups.		
, ,	e de de la come de la mont gour ononioù in onder mixoù groupe una provont tooute te target groupe.			
Autonomy	Students are able to recognize and improve knowled	ge deficits independently.		
	With instructor assistance, students are able to evalua	ate their own knowledge level and define a further co	urse of study.	
Workload in Hours	Independent Study Time 124, Study Time in Lecture 5	56	-	
Credit points				
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Sp	ecialisation Mechanical Engineering, Focus Mechatro	onics: Compulsory	
Curricula	General Engineering Science (German program): Sp			Compulsory
	General Engineering Science (German program): Sp			
	General Engineering Science (German program, 7 se	emester): Specialisation Mechanical Engineering, Fo	cus Mechatronics: Co	mpulsory
	General Engineering Science (German program, 7 se	emester): Specialisation Mechanical Engineering, Fo	cus Aircraft Systems E	ingineering: Compulsor
	General Engineering Science (German program, 7	semester): Specialisation Mechanical Engineering	, Focus Theoretical I	Mechanical Engineerir
	Elective Compulsory			
	General Engineering Science (English program): Spe	ecialisation Mechanical Engineering, Focus Aircraft S	ystems Engineering: (Compulsory
	General Engineering Science (English program): Spe	ecialisation Mechanical Engineering, Focus Mechatro	nics: Compulsory	
	General Engineering Science (English program): Spe	ecialisation Mechanical Engineering, Focus Theoretic	al Mechanical Engine	ering: Compulsory
	General Engineering Science (English program, 7 se			
	General Engineering Science (English program, 7 se		-	• • •
	General Engineering Science (English program, 7	semester): Specialisation Mechanical Engineering	, Focus Theoretical I	Mechanical Engineerir
	Elective Compulsory			
	Mechanical Engineering: Specialisation Aircraft Syste			
	Mechanical Engineering: Specialisation Mechatronic	1 5		
	Mechanical Engineering: Specialisation Theoretical M Mechatronics: Core qualification: Compulsory	viecnanicai Engineering: Compulsory		

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



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



Design			
	Тур	Hrs/wk	CP
	Lecture	3	4
	Recitation Section (small)	1	2
(rautschneider			
f electrical engineering			
S			
successfully, students have reached the follo	wing learning results		
		ications.	
know the appropriate rields for the use of bip			
		f electronic circuits.	
	• • • •		
can use MOS devices, operational amplifiers	s and bipolar transistors for specific application	ns.	
are able work efficiently in heterogeneous te	ams.		
working together in small groups can solve p	problems and answer professional questions.		
are able to assess their level of knowledge.			
udy Time 124, Study Time in Lecture 56			
• • • • • •		-	
,		us Mechatronics: Com	pulsory
	ngineering: Elective Compulsory		
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		us iviecnatronics: Com	Juisory
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atics: Specialisation III. Engineering Science:			
	s are able to explain the functionality of differe s know the fundamental digital logic circuits as s have solid knowledge about memory circuits s are able to explain how analog circuits funct s know the appropriate fields for the use of bip s can calculate the specifications of different M s are able to develop different logic circuits an s can use MOS devices, operational amplifier s can use MOS devices, operational amplifier s working together in small groups can solve p s are able to assess their level of knowledge. udy Time 124, Study Time in Lecture 56 evering Science (German program): Specialisa pering Science (German program): Specialisa evering Science (German program): Specialisa evering Science (German program): Specialisat pering Science (German program): Specialisat evering Science (English program, 7 semester) seering Science (English program, 7 semester) evering Science (English program, 7 semester) seering Science (English program, 7 semester)	of electrical engineering cs tsuccessfully, students have reached the following learning results s are able to explain the functionality of different MOS devices in electronic circuits. s have solid knowledge about memory circuits and can discuss their advantages and disadvar s have solid knowledge about memory circuits and can explain their functionality and specif s are able to explain how analog circuits functions and where they are applied. s know the appropriate fields for the use of bipolar transistors. s can calculate the specifications of different MOS devices and can define the parameters or s are able to develop different logic circuits and can design different types of logic circuits. s can use MOS devices, operational amplifiers and bipolar transistors for specific applicatio s are able to develop different logic circuits and can design different types of logic circuits. s can use MOS devices, operational amplifiers and bipolar transistors for specific application s are able to assess their level of knowledge. tudy Time 124, Study Time in Lecture 56 tudy Time 124, Study Time in Lecture 56 tering Science (German program): Specialisation Electrical Engineering; Compulsory sering Science (German program): Specialisation Mechanical Engineering, Focus Mechartor pering Science (German program): Specialisation Electrical Engineering, Focus Mechartor pering Science (German program): Specialisation Electrical Engineering, Focus Mechartor pering Science (German program): Specialisation Electrical Engineering, Focus Mechartor pering Science (English program): Specialisation Electrical Engineering; Compulsory teering Science (English program): Specialisation Electrical Engineering; Focus Mechartor pering Science (English program): Specialisation Electrical Engineering; Compulsory teering Science (English program): Specialisation Electrical Engineering; Compulsory teering Science (English program): Specialisation Electrical Engineering; Compulsory teering Science (English program, 7 sem	of electrical engineering CS Tsuccessfully, students have reached the following learning results s are able to explain the functionality of different MOS devices in electronic circuits. s how the fundamental digital logic circuits and can discuss their advantages and disadvantages. s have solid knowledge about memory circuits and can explain their functionality and specifications. s are able to explain how analog circuits functions and where they are applied. s know the appropriate fields for the use of bipolar transistors. s are able to evelop different logic circuits and can explain their functionality and specifications circuits. s act calculate the specifications of different MOS devices and can define the parameters of electronic circuits. s are able to develop different logic circuits and can design different types of logic circuits. s can use MOS devices, operational amplifiers and bipolar transistors for specific applications. s are able to develop different logic circuits and can design different types of logic circuits. s are able to assess their level of knowledge. udy Time 124, Study Time in Lecture 56 sering Science (German program): Specialisation Electrical Engineering: Compulsory sering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory sering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory sering Science (German program): Specialisation Electrical Engineering, Focus Mechatronics: Compulsory sering Science (English program): Specialisation Electrical Engineering, Focus Mechatronics: Compulsory sering Science (English program): Specialisation Electrical Engineering, Focus Mechatronics: Compulsory sering Science (English program): Specialisation Electrical Engineering, Focus Mechatronics: Compulsory sering Science (English program): Specialisation Electrical Engineering, Focus Mechatronics: Compulsory sering Science (English program): Specialisation Electrical Engineering; Focus Mechatronics: Compulsory se



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 perfomance improvements Operational amplifiers and their applications Basic circuits with bipolar transistors Design of exemplary circuits Electrical behavoir of BiCMOS circuits R. J. Baker, CMOS - Circuit Design, Layout and Simulation, J. Wiley & Sons Inc., 3. Auflage, 2011, ISBN: 047170055S
	 HG. Wagemann und T. Schönauer, Silizium-Planartechnologie, Grundprozesse, Physik und Bauelemente, Teubner-Verlag, 2003, ISBN 3519004674 K. Hoffmann, Systemintegration, Oldenbourg-Verlag, 2. Aufl. 2006, ISBN: 3486578944 U. Tietze und Ch. Schenk, E. Gamm, Halbleiterschaltungstechnik, Springer Verlag, 14. Auflage, 2012, ISBN 3540428496 H. Göbel, Einführung in die Halbleiter-Schaltungstechnik, Berlin, Heidelberg Springer-Verlag Berlin Heidelberg, 2011, ISBN: 9783642208874 ISBN: 9783642208867 URL: http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10499499 URL: http://dx.doi.org/10.1007/978-3-642-20887-4 URL: http://ebooks.ciando.com/book/index.cfm/bok_id/319955 URL: http://www.ciando.com/img/bo

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 Manual B. Sc. "General Engineering Science (English program)"



Module M0854: Mathematic	es IV			
•				
Courses				
Title		Тур	Hrs/wk	CP
Differential Equations 2 (Partial Differentia		Lecture	2	1
Differential Equations 2 (Partial Differentia		Recitation Section (small)	1	1
Differential Equations 2 (Partial Differentia Complex Functions (L1038)	Equations) (L1045)	Recitation Section (large) Lecture	1 2	1
Complex Functions (L1038)		Recitation Section (small)	1	1
Complex Functions (L1042)		Recitation Section (Iarge)	1	1
	Prof. Anusch Taraz	ricolitation occition (large)		1
Module Responsible				
Admission Requirements	none			
Recommended Previous	Mathematics 1 - III			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	ng learning results		
Professional Competence				
Knowledge				
-	 Students can name the basic concepts in Mathematics I 	V. They are able to explain them using appro	priate examples.	
	 Students can discuss logical connections between these 	e concepts. They are capable of illustrating t	hese connections w	ith the help of example
	 They know proof strategies and can reproduce them. 			
Skills				
Skills	Students can model problems in Mathematics IV with th	e help of the concepts studied in this course	. Moreover, they are	e capable of solving the
	by applying established methods.			
	 Students are able to discover and verify further logical c 	onnections between the concepts studied in	the course.	
	 For a given problem, the students can develop and exec 			esults.
Personal Competence				
Social Competence				
	 Students are able to work together in teams. They are ca 			
	 In doing so, they can communicate new concepts according 	rding to the needs of their cooperating partr	ners. Moreover, they	v can design examples
	check and deepen the understanding of their peers.			
Autonomy	 Students are capable of checking their understanding 	of complex concepts on their own. They car	n specify open ques	tions precisely and kn
Autonomy	 Students are capable of checking their understanding where to get help in solving them. 	of complex concepts on their own. They car	n specify open ques	tions precisely and kn
Autonomy	where to get help in solving them.			
Autonomy				
Autonomy	where to get help in solving them.			
Autonomy	where to get help in solving them.			
Autonomy Workload in Hours	where to get help in solving them.			
	where to get help in solving them. Students have developed sufficient persistence to be ab 			
Workload in Hours	where to get help in solving them. Students have developed sufficient persistence to be ab Independent Study Time 68, Study Time in Lecture 112			
Workload in Hours Credit points Examination	where to get help in solving them. • Students have developed sufficient persistence to be ab Independent Study Time 68, Study Time in Lecture 112 6 Written exam			
Workload in Hours Credit points Examination Examination duration and scale	where to get help in solving them. • Students have developed sufficient persistence to be ab Independent Study Time 68, Study Time in Lecture 112 6 Written exam 60 min (Complex Functions) + 60 min (Differential Equations 2)	le to work for longer periods in a goal-orient		
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	where to get help in solving them. • Students have developed sufficient persistence to be at Independent Study Time 68, Study Time in Lecture 112 6 Written exam 60 min (Complex Functions) + 60 min (Differential Equations 2) General Engineering Science (German program): Specialisatio	le to work for longer periods in a goal-orient	ed manner on hard	
Workload in Hours Credit points Examination Examination duration and scale	where to get help in solving them. • Students have developed sufficient persistence to be ab Independent Study Time 68, Study Time in Lecture 112 6 Written exam 60 min (Complex Functions) + 60 min (Differential Equations 2) General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio	le to work for longer periods in a goal-orient n Electrical Engineering: Compulsory n Mechanical Engineering, Focus Mechatror	ed manner on hard	problems.
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Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	where to get help in solving them. • Students have developed sufficient persistence to be ab Independent Study Time 68, Study Time in Lecture 112 6 Written exam 60 min (Complex Functions) + 60 min (Differential Equations 2) General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio	le to work for longer periods in a goal-orient n Electrical Engineering: Compulsory n Mechanical Engineering, Focus Mechatror n Mechanical Engineering, Focus Theoretica	ed manner on hard	problems.
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Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	where to get help in solving them. • Students have developed sufficient persistence to be ab Independent Study Time 68, Study Time in Lecture 112 6 Written exam 60 min (Complex Functions) + 60 min (Differential Equations 2) General Engineering Science (German program): Specialisatio General Engineering Science (German program): Specialisatio	le to work for longer periods in a goal-orient n Electrical Engineering: Compulsory n Mechanical Engineering, Focus Mechatror n Mechanical Engineering, Focus Theoretica n Naval Architecture: Compulsory Specialisation Electrical Engineering: Compu Specialisation Mechanical Engineering, Focu	ed manner on hard p nics: Compulsory al Mechanical Engin ulsory us Mechatronics: Co	eering: Compulsory
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	where to get help in solving them. • Students have developed sufficient persistence to be ab Independent Study Time 68, Study Time in Lecture 112 6 Written exam 60 min (Complex Functions) + 60 min (Differential Equations 2) General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): S General Engineering Science (German program) (S semester) (S semest	le to work for longer periods in a goal-orient n Electrical Engineering: Compulsory n Mechanical Engineering, Focus Mechatror n Mechanical Engineering, Focus Theoretica n Naval Architecture: Compulsory Specialisation Electrical Engineering: Compu Specialisation Mechanical Engineering, Focu	ed manner on hard p nics: Compulsory al Mechanical Engin ulsory us Mechatronics: Co	eering: Compulsory
Workload in Hours Credit points Examination Examination duration and scale Assignment for the Following	where to get help in solving them. • Students have developed sufficient persistence to be ab Independent Study Time 68, Study Time in Lecture 112 6 Written exam 60 min (Complex Functions) + 60 min (Differential Equations 2) General Engineering Science (German program): Specialisatio General Engineering Science (German program, 7 semester): S General Engineering Science (German program) (le to work for longer periods in a goal-orient n Electrical Engineering: Compulsory n Mechanical Engineering, Focus Mechatror n Mechanical Engineering, Focus Theoretica n Naval Architecture: Compulsory Specialisation Electrical Engineering: Compu Specialisation Mechanical Engineering, Focu): Specialisation Mechanical Engineering,	ed manner on hard nics: Compulsory al Mechanical Engin ulsory us Mechatronics: Co Focus Theoretical	eering: Compulsory
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Course L1043: Differential Equations 2 (Partial Differential Equations)		
Тур	Lecture	
Hrs/wk	2	
CP	1	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH	
Language	DE	
Cycle	SoSe	
Content	Main features of the theory and numerical treatment of partial differential equations	
	 Examples of partial differential equations First order quasilinear differential equations Normal forms of second order differential equations Harmonic functions and maximum principle Maximum principle for the heat equation Wave equation Liouville's formula Special functions Difference methods Finite elements 	
Literature	 http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html 	

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

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

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



Course L1041: Complex Functions	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course
Course L1042: Complex Functions	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14

Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course



Focus Product Development and Production

The specialization Product Development and Production in the field of study Mechanical Engineering of the course of study General Engineering Science enables a consecutive study of the master Product Development and Production. The specialization maps the product creation process from systematic and methodical development of products, including concept development, design, utilisation of 3D-CAD and Product data management systems, material selection, simulation and test to production, the planning and control and the use of modern manufacturing processes, to high-performance materials.

Module M0597: Advanced Mechanical Engineering Design Courses Title Typ Hrs/wk CP Advanced Mechanical Engineering Design II (L0264) Lecture 2 Advanced Mechanical Engineering Design II (L0265) Recitation Section (large) 2 1 Advanced Mechanical Engineering Design I (L0262) Lecture 2 2 Advanced Mechanical Engineering Design I (L0263) Recitation Section (large) 2 Module Responsible Prof. Dieter Krause Admission Requirements None **Recommended Previous** • Fundamentals of Mechanical Engineering Design Knowledge Mechanics · Fundamentals of Materials Science Production Engineering Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence After passing the module, students are able to: Knowledge • explain complex working principles and functions of machine elements and of basic elements of fluidics, explain requirements, selection criteria, application scenarios and practical examples of complex machine elements. indicate the background of dimensioning calculations. Skills After passing the module, students are able to accomplish dimensioning calculations of covered machine elements. • transfer knowledge learned in the module to new requirements and tasks (problem solving skills), • recognize the content of technical drawings and schematic sketches, · evaluate complex designs, technically. Personal Competence Social Competence Students are able to discuss technical information in the lecture supported by activating methods. Autonomy · Students are able to independently deepen their acquired knowledge in exercises · Students are able to acquire additional knowledge and to recapitulate poorly understood content e.g. by using the video recordings of the lectures Independent Study Time 68, Study Time in Lecture 112 Workload in Hours Credit points 6 Examination Written exam Examination duration and scale 120 Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory Curricula General Engineering Science (German program); Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering; Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production



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. Computsory

Course L0264: Advanced Mechanical Engineering Design II		
Typ Hrs/wk	2	
CP		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff	
Language	DE	
Cycle	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 1-2, Schecht, B., Pearson Verlag, actuelle Auflage. Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. 	
	 Maschmenelemente - Gestalung, 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



Instruct 2 Image: Control of the second of the s	ourse L0262: Advanced Mechanic	al Engineering Design I
OP 2 Workload in Hours Independent Study Time is Ledure 28 Lecture Periol. Dieter Krause, Prot. Otto von Estortt Language DE Cycle WS6 Content Advanced Mechanical Engineering Design 1 & I Lecture • Fundamentals of the following machine elements: • Linear rolling bearings • Axes & shafts • Seals • Clutches & brakes • Gear drives • Gear drives • Gear drives • Stiding bearings • Clutches & brakes • Stiding bearings • Stiding bearings • Clutches & brakes • Stiding bearings • Clutches & brakes • Stiding bearings • Clutches & brakes • Stiding bearings • Meachinenenenne, Band I III, Nemann, Cl, Springer-Verlag, aktuelle Autlage.	Тур	Lecture
Workload in Hours Independent Study Time 32. Study Time in Lecture 28 Lecture Pot. Diter Krause, Prof. Cito von Extorif Language DE Cyce WiSe Content Advanced Mechanical Engineering Design 1 & I Lecture Fundamentals of the following machine elements: Linear rolling bearings Axes & shafts Seals Olubtes & brakes Belt & chain drives Gard drives Elements of fluidics Exercise Calculation methods of the following machine elements: Stafting bearings Calculation methods of the following machine elements: Linear rolling bearings Calculation methods of the following machine elements: Calculation methods of the following machine elements: Linear rolling bearings Calculation methods of the following machine elements: Linear rolling bearings Calculation flows Gard drives Elements of fluidics Calculations of rydrostatic systems (fluidics) Calculations of rydrostatic systems (fluidics) Calculations of rydrostatic systems (fluidics) Calculations of rydrostatic sy	Hrs/wk	2
Lecture Prof. Dileter Krause, Prof. Olto vin Estorff Language DE Cycle WSe Content Advanced Mechanical Engineering Design I & II Lecture Fundamentals of the following machine elements: Linear rolling bearings Avea & shafts Seals Clutches & shafts Seals Clutches & brankes Epicyclic gears Clatches & tothin drives Grank drives Silding bearings Avea & shafts Clatches & brankes Silding bearings Elements of fluidics Exercise Clatches & brankes Gliding bearings Linear rolling bearings Avea & shafts Clutches & brankes Belt & chain drives Gliding bearings Avea & shafts Clutches & brankes Belt & chain drives Gliding bearings Clatches & brankes Belt & chain drives Gliding bearings Clatches & brankes Siding bearings Clatches & brankes Siding bearings Clatches on thydrostafte systems (fluidics) Literature Ubbelt, Taschenbuch für den Maschinenbai: Grove,	CP	2
Language DE Cycle Wills Content Advanced Mechanical Engineering Design I & II Lecture • Fundamentals of the following machine elements: • Linear rolling bearings • Axes & shafts • Seals • Clutches & brakes • Belf & chain drives • Gear drives • Epicyclic gears • Crank drives • Sidiling bearings • Sidiling bearings • Elements of fluidics Exercise • Calculation methods of the following machine elements: • Linear rolling bearings • Sidiling bearings • Calculation methods of the following machine elements: • Linear rolling bearings • Axes & shafts • Clutches & brakes • Belf & chain drives • Gear drives • Calculation methods of the following machine elements: • Linear rolling bearings • Calculation methods of the following machine elements: • Linear rolling bearings • Calculation methods of the following machine elements: • Linear rolling bearings • Calculation methods of the following machine elements: • Linear rolling bearings • Calculation methods of the following machine elements: • Linear rolling bearings • Calculation of hydrostatic systems (fluidics) Literature • Dubbel, Taschenbuch für den Maschinenbau: Grove, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. • Maschinereiments, Band I-III; Nemann, G., Springer-Verlag, aktuelle Auflage. • EinDubrug in die DN-Normer: Verlag, Schueler Verlag, aktuelle Auflage. • EinDubrug in die DN-Normer: Verlag, aktuelle Auflage. • Konstruktionselemente; Stein hilper, W., Röper, R., Springer-Verlag, aktuelle Auflage. • Konstruktionselemente; Stein hilper, W., Röper, R., Springer-Verlag, aktuelle Auflage.	Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Cycle WiSe Content Advanced Mechanical Engineering Design I & II Lecture • • Fundamentals of the following machine elements: • • • Linear rolling bearings • • • Aves & shafts • • • Seals • • • Elements of the following machine elements: • • • Belt & chain drives • • • Belt & chain drives • • • Elements of thudics Exercise • • Calculation methods of the following machine elements: • • Linear rolling bearings • • Calculation methods of the following machine elements: • • Linear rolling bearings • • Calculation methods of the following machine elements: • • Linear rolling bearings • • Calculation methods of the following machine elements: • • Linear rolling bearings • • Calculation of thudics • Elements of thudics • <t< th=""><th>Lecturer</th><th>Prof. Dieter Krause, Prof. Otto von Estorff</th></t<>	Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Context Advanced Mechanical Engineering Design 1 & II Lecture • Fundamentals of the following machine elements: • Linear rolling bearings • Area & shafts • Seals • Cluches & brakes • Beit & chain drives • Gear drives • Delt & chain drives • Crank drives • Siding bearings • Crank drives • Siding bearings • Cluches & brakes • Siding bearings • Cluches & brakes • Siding bearings • Cluches & brakes • Cluches & brak	Language	DE
Lecture Fundamentals of the following machine elements: Linear rolling bearings Axes & shafts Seals Cluthes & brakes Belt & chain drives Class & brakes Belt & chain drives Class & or Crank drives Sealis Cluthes & brakes Sealis Class & or Crank drives Sealing bearings Crank drives Sitiating bearings Exercise Linear rolling bearings Class & brakes Sitiating bearings Axes & shafts Cluthes & brakes Belt & chain drives Cluthes & brakes Belt & chain drives Gear drives Sitiating bearings Axes & shafts Cluthes & brakes Belt & chain drives Gear drives Epicyclic gears Cluthes & brakes Belt & chain drives Gear drives Epicyclic gears Sitiating bearings Literature Dubbel, Taschenbuch für den Maschinenbau; Cirote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage. Maschinene- und Konstruktionselemente; Steinhilger, W., Springer-Verlag, aktuelle Auflage. Maschinene- und Konstruktionselemente; Steinhilger, W., Springer-Verlag, aktuelle Auflage. Einföffhumgi rud ici DN-Normen; Klein, M., Teroben	Cycle	WiSe
 Fundamentals of the following machine elements: Linear rolling bearings Axes & shafts Seals Clutches & brakes Belt & chain drives Gear drives Epicyclic gears Crank drives Silding bearings Elements of fluidics Exercise Elements of fluidics Exercise Clutches & brakes Belt & chain drives Silding bearings Linear rolling bearings Linear rolling bearings Axes & shafts Clutches & brakes Belt & chain drives Gear drives Belt & chain drives Gear drives Elericit gears Silding bearings Clutches & brakes Belt & chain drives Gear drives Eloicyclic gears Silding bearings Catculations of hydrostatic systems (fluidics) 	Content	Advanced Mechanical Engineering Design I & II
 Linear rolling bearings Axes & shafts Seals Clubches & brakes Belt & chain drives Gear drives Epicyclic gears Stiding bearings Elements of fluidics Everoise Clubches & brakes Bilding bearings Elements of fluidics Elements of fluidics Clubches & brakes Belt & chain drives Stiding bearings Elements of fluidics 		Lecture
 Linear rolling bearings Axes & shafts Seals Clubches & brakes Belt & chain drives Gear drives Epicyclic gears Stiding bearings Elements of fluidics Everoise Clubches & brakes Bilding bearings Elements of fluidics Elements of fluidics Clubches & brakes Belt & chain drives Stiding bearings Elements of fluidics 		Fundamentals of the following machine elements:
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• Gear drives • Epicyclic gears • Crank drives • Silding bearings • Elements of fluidics • Elements of fluidics • Calculation methods of the following machine elements: • Calculation methods of the following machine elements: • Linear rolling bearings • Linear rolling bearings • Axes & shafts • Clutches & brakes • Belt & chain drives • Gear drives • Belt & chain drives • Gear drives • Belt & chain drives • Gear drives • Siding bearings • Calculations of hydrostatic systems (fluidics) • Calculations of hydrostatic systems (fluidics)		
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• Konstruktionslehre, Pahl, G.; Beitz, W., Springer-Verlag, aktuelle Auflage.		
 Maschinenelemente 1-2: Schlecht, B., Pearson Verlag, aktuelle Auflage. 		
Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.		 Hololivinatek waschinenelemente; wittel, H., Muns, D., Jannasch, D., Voßlek, J., Springer Vieweg, aktuelle Auflage.
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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



Nodule M0596: Advanced I	lechanical Design Project			
courses				
ïtle	т	ур	Hrs/wk	CP
dvanced Mechanical Design Project (L02	66) P	ractical Course	4	6
Module Responsible	Prof. Dieter Krause			
Admission Requirements	None			
Recommended Previous	- Made del Erabas des Dadas			
Knowledge	Mechanical Engineering: Design			
	Advanced Mechanical Engineering Design			
Educational Objectives	After taking part successfully, students have reached the following learning re-	sults		
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. 			
	- p			
Skills	After passing the module, students are able to:			
	analyze complex tasks and develop principle solutions using sketches	i.		
	 convert principle solutions into a detailed design, 	3		
	 use methods to design and solve engineering design tasks systematic 	ally and solution-oriented.		
	create a technical documentation including all necessary technical dra			
	document calculations of selected machine elements clearly and in de			
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 people the module, students are able to:			
Autonomy	After passing the module, students are able to:			
	independently solve complex design projects, while motivating themse	elves, acquiring necessary	v knowledge and selecting	g appropriate method
	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			
		Facilitation Facult Aircon	th Current and Family and a strange	2
Assignment for the Following	General Engineering Science (German program): Specialisation Mechanical I			
Curricula	General Engineering Science (German program): Specialisation Mechanical I General Engineering Science (German program): Specialisation Mechanical I			
	General Engineering Science (German program). Specialisation Mechanical I General Engineering Science (German program, 7 semester): Specialisation I			
	General Engineering Science (German program, 7 semester): Specialisation			
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	General Engineering Science (German program, 7 semester): Specialisation	on Mechanical Engineeri	ing. Focus Theoretical M	lechanical Engineer
	Compulsory			
	General Engineering Science (English program): Specialisation Mechanical E	Engineering, Focus Aircraf	t Systems Engineering: C	Compulsory
	General Engineering Science (English program): Specialisation Mechanical E			
	General Engineering Science (English program): Specialisation Mechanical E	0 0,		1 3
	General Engineering Science (English program, 7 semester): Specialisation N	-	, e	
	General Engineering Science (English program, 7 semester): Specialisation			
	Compulsory	-		
	General Engineering Science (English program, 7 semester): Specialisation	on Mechanical Engineeri	ng, Focus Theoretical M	lechanical Engineer
	Compulsory	-		-
	Mechanical Engineering: Core qualification: Compulsory			



Course L0266: Advanced Mechanic	
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 M1009: Material Sci	ience Laboratory			
	lence Laboratory			
Courses				
Title		Тур	Hrs/wk	CP
Companion Lecture for Materials Science	Laboratory (L1088)	Lecture	2	2
Material Science Laboratory (L1235)		Laboratory Course	4	4
Module Responsible	Prof. Bodo Fiedler			
Admission Requirements	none			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	Students are able to give a summary of the technical de	tails of experiments in the area of materials scie	ences and illustrate respe	ective relationships. Th
	are capable of describing and communicating relevan	t problems and questions using appropriate t	echnical language. They	can explain the typi
	process of solving practical problems and present relate	d results.		
Skille	The students can transfer their fundamental knowledge	on material sciences to the process of solving	a practical problems. The	w identify and overco
- OKINS	typical problems during the realization of experiments in		g practical problems. The	y identity and overco
		and context of material objerioes.		
Personal Competence				
Social Competence	Students are able to cooperate in small groups in order to conduct experiments in the context of materials sciences. They are able to effectively presen			
	and explain their results alone or in groups in front of a c	ualified audience.		
Autonomy	Students are capable of solving problems in the contex	t of materials sciences using provided literatu	ire. They are able to fill g	aps in as well as exte
	their knowledge using the literature and other sources p	rovided by the supervisor.		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Colloquium			
Examination duration and scale	1,5 h written Exam (50%) covering the lesson			
Assignment for the Following	General Engineering Science (German program): Speci	alisation Mechanical Engineering, Focus Mater	ials in Engineering Scier	ces: Compulsory
Curricula	General Engineering Science (German program): Speci	alisation Mechanical Engineering, Focus Produ	uct Development and Pro	duction: Compulsory
	General Engineering Science (German program, 7 s	emester): Specialisation Mechanical Enginee	ring, Focus Materials in	Engineering Science
	Compulsory			
	General Engineering Science (English program): Specia	alisation Mechanical Engineering, Focus Materi	als in Engineering Scien	ces: Compulsory
	General Engineering Science (English program): Specia	alisation Mechanical Engineering, Focus Produ	ct Development and Proc	luction: Compulsory
	General Engineering Science (English program, 7 s	emester): Specialisation Mechanical Enginee	ring, Focus Materials in	Engineering Scienc
	Compulsory			
	Mechanical Engineering: Specialisation Product Develo	pment and Production: Compulsory		
	Mechanical Engineering: Specialisation Materials in Eng			
	Product Development, Materials and Production: Techni			

Course L1088: Companion Lecture	for Materials Science Laboratory
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Patrick Huber
Language	DE
Cycle	WiSe
Content	Physico-chemical backgrounds and fundamental experimental principles with regard to the following experiments, the topics to be addressed are
	indicated in brackets for each experiment:
	1. Phase diagrams, heat treatment, hardness measurements (thermodynamics, elastic properties of solids)
	2. notch impact test (elastic properties of solids)
	3. Processes during the solidifaction of metals (thermodynamics and kinetics of solid-liquid phase transitions)
	4. tensile test (elastic properties of solids)
	5. Identificiation of polymers (polymer physics)
	6. fiber-reinforced polymers (physical principles of composite materials)
	7. Production and microstructure of ceramic materials (physico-chemical principles of ceramics)
	8. Mechanical properties of ceramic materials (elastic properties of solids and composite materials)
Literature	William D. Callister und David G. Rethwisch, Materialwissenschaften und Werkstofftechnik, Wiley&Sons, Asia (2011)
	William D. Callister, Materials Science and Technology, Wiley& Sons, Inc. (2007)



Course L1235: Material Science Lab	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



Module M0726: Production	Technology			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Machine Tools (L0689)		Lecture	3	3
Forming and Cutting Technology (L0613)		Lecture	2	2
Forming and Cutting Technology (L0614)		Recitation Section (large)	1	1
Module Responsible	Prof. Wolfgang Hintze			
Admission Requirements	None			
Recommended Previous	without major course assessment			
Knowledge				
	internship recommended			
	Previous knowledge in mathematics, mechanics and elect	rical engineering		
Educational Objectives	After taking part successfully, students have reached the for	ollowing learning results		
Professional Competence				
Knowledge	Students are able to			
	explain the basics of chip formation and mechanism	•	and to all	
	explain methods and parameters for design and an			
	 explain technical concepts of machine tool building explain types, constructions and functions of CNC- 			
	 explain types, constructions and functions of enco- explain equipment components. 	machines and give an overview on multi-mach	ine systems.	
	• explain equipment components.			
Skills	Students are able to			
	select tool geometry, cutting materials, process part	ameters and appropriate measuring technique	e in accordance with the	e requirements.
	estimate occurring forces and temperatures during	chip formation.		
	select appropriate machine tools for machining and	d create 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			
oodal oompetende				
	 develop solutions in a production environment with 	qualified personnel at technical level and rep	present decisions.	
Autonomy	Students are able to			
,				
	interpret independently cutting processes.			
	create independently NC programs.			
	select independently machine tools by reference to	appropriate requirements.		
	assess own strengths and weaknesses in general.			
	 assess their learning progress and define gaps to l assess possible consequences of their actions 	be improved.		
	 assess possible consequences of their actions. 			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points				
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Special			
Curricula	General Engineering Science (German program, 7 semi	ester): Specialisation Mechanical Engineering	g, Focus Product Deve	lopment and Production
	Compulsory			
	General Engineering Science (English program): Speciali			
	General Engineering Science (English program, 7 seme	ester): Specialisation Mechanical Engineering	g, Focus Product Deve	lopment and Production
	Compulsory			
	Mechanical Engineering: Specialisation Product Develop	1 5		
	Product Development, Materials and Production: Technica	I Complementary Course Core Studies: Electi	ve Compulsory	



Typ Lacture HYM 3 OP 3 Workladd in Hours Independent Study Time in Lecture 42 Language DE Oyde Wile Content Terminology and trends in machine tool building Optimum Content Terminology and trends in machine tool building Chicotania NC programming and NC programming systems Types, construction and function of CNC machines Multi-machinesystema Equipmenticomponents for machine tools Assessment of machine tools Assessment of machine tools Assessment of machine tools Spannado Werkzeugmaschinen syst844640814 Fachbuchurd der Werkzeugmaschinen syst844640814 Fachbuchureng 2006 Werk, Minfend Spannado Werkzeugmaschinen - Austütinungstormen und Vergleichstabellen ISBN: 554089529 Berlin [u.a]: Springer, 2009 Werk, Manfred Werkzeugmaschinen 1 - Maschinenarten und Anvendungsbereiche ISBN: 9783540225041 Berlin [u.a]: Springer, 2005 Werk, Manfred: Brecher, Christen Werkzeugmaschinen 4 - Automatisterung von Maschinen und Antagen ISBN: 9340225072 Verder <th>Course L0689: Fundamentals of Mac</th> <th>chine Tools</th>	Course L0689: Fundamentals of Mac	chine Tools
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Werkzeugmaschinen 5 - Messtechnische Untersuchung und Beurteilung, dynamische Stabilität		Werkzeugmaschinen 5 - Messtechnische Untersuchung und Beurteilung, dynamische Stabilität
ISBN: 3540225056		ISBN: 3540225056
Berlin [u.a.]: Springer, 2006		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 <i>Massivumformung</i> , 4. Auflage, VDI-Verlag (1996) König, W., Klocke, F.; Fertigungsverfahren Bd. 5 <i>Blechbearbeitung</i> , 3. Auflage, VDI-Verlag (1995) Klocke, F., König, W.; Fertigungsverfahren <i>Schleifen, Honen, Läppen</i> , 4. Auflage, Springer Verlag (2005) König, W., Klocke, F.: Fertigungsverfahren <i>Drehen, Fräsen, Bohren</i> , 7. Auflage, Springer Verlag (2002)

Course L0614: Forming and Cutting	Technology
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Wolfgang Hintze
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course



Courses				
Title		Тур	Hrs/wk	CP
CAE-Team Project (L0271)		Problem-based Learning	2	2
Development of Lightweight Design Produc		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	o following learning results		
Professional Competence				
Knowledge	After completing the module, students are capable of:			
	 explaining the functional principle of 3D-CAD-Sy 	vstems, PDM- and FEM-Systems		
	 describing the interaction of the different CAE-Sy 			
01.111				
Skills				
	After completing the module, students are able to:			
	 evaluate different CAD- and PDM-Systems with design an exemplary product using CAD-,PDM- 		sification schemes and	product structuring
Personal Competence				
Social Competence	After completing the module, students are able to:			
	 To develop a project plan and allocate work app 	ropriate work packages in the framework of grou	n discussions	
	 Present project results as a team for instance in 			
Autonomy	Students are capable of:			
	 independently adapt to a CAE-Tool and complet 	e a given practical task with it		
Workload in Hours	Independent Study Time 06, Study Time in Lecture 94			
Credit points	Independent Study Time 96, Study Time in Lecture 84			
Examination	Written exam			
Examination duration and scale	90			
Assignment for the Following	General Engineering Science (German program): Speci	alisation Mechanical Engineering Focus Aircraft	Systems Engineering:	Compulsory
Curricula	General Engineering Science (German program): Speci	6 6,	, 0 0	1
	General Engineering Science (German program, 7 sem			
	General Engineering Science (German program, 7 se	mester): Specialisation Mechanical Engineering	, Focus Product Deve	lopment and Productio
	Compulsory			
	General Engineering Science (English program): Speci-	alisation Mechanical Engineering, Focus Aircraft	Systems Engineering: (Compulsory
	General Engineering Science (English program): Speci	alisation Mechanical Engineering, Focus Product	Development and Proc	duction: Compulsory
	General Engineering Science (English program, 7 seme	ester): Specialisation Mechanical Engineering, Fo	cus Aircraft Systems Er	ngineering: Compulsor
	General Engineering Science (English program, 7 se	mester): Specialisation Mechanical Engineering	, Focus Product Devel	opment and Production
	Compulsory			
	Mechanical Engineering: Specialisation Product Develo	opment and Production: Compulsory		
	Mechanical Engineering: Specialisation Aircraft System	E de la companya de la		



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

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

Course L0269: Integrated Product Development I	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause
Language	DE
Cycle	SoSe
Content	 Introduction to Integrated Product Development 3D CAD -Systems and CAD interfaces Administration of part lists / PDM systems PDM in different industries Selection of CAD-/PDM Systems Simulation Construction methods Design for X
Literature	 Ehrlenspiel, K.: Integrierte Produktentwicklung, München, Carl Hanser Verlag Lee, K.: Principles of CAD / CAM / CAE Systems, Addison Wesles Schichtel, M.: Produktdatenmodellierung in der Praxis, München, Carl Hanser Verlag Anderl, R.: CAD Schnittstellen, München, Carl Hanser Verlag Spur, G., Krause, F.: Das virtuelle Produkt, München, Carl Hanser Verlag



Focus Theoretical Mechanical Engineering

	h that a continuous study in the Master program in Theore Mechanical Engineering Design			
Courses				
Title		Тур	Hrs/wk	CP
Advanced Mechanical Engineering Design		Lecture	2	2
Advanced Mechanical Engineering Design		Recitation Section (large) Lecture	2	1
Advanced Mechanical Engineering Desigr Advanced Mechanical Engineering Desigr		Recitation Section (large)	2	2
			-	•
Module Responsible				
Admission Requirements	None			
Recommended Previous	Fundamentals of Mechanical Engineering Design			
Knowledge	Mechanics			
	Fundamentals of Materials Science			
	Production Engineering			
Educational Objectives	After taking part successfully, students have reached the following part successfully and the students have reached the following part successfully and the students have reached the following part successfully and the students have reached the following part successfully and the students have reached the following part successfully and the students have reached the following part successfully and the students have reached the following part successfully and the students have reached the following part successfully and the students have reached the following part successfully and the students have reached the following part successfully and the students have reached the students have been successfully and the students have reached the students have been successfully and the students have been suc	owing learning results		
Professional Competence				
Knowledge	After passing the module, students are able to:			
	explain complex working principles and functions of			
	explain requirements, selection criteria, application s		lachine elements,	
	 indicate the background of dimensioning calculations 	S.		
Skills	After passing the module, students are able to:			
	 accomplish dimensioning calculations of covered ma 			
	 transfer knowledge learned in the module to new req 			
	 recognize the content of technical drawings and sche 	ematic sketches,		
	 evaluate complex designs, technically. 			
Personal Competence				
Social Competence				
ecolar competence	Students are able to discuss technical information in	the lecture supported by activating methods.		
A				
Autonomy	• Students are able to independently deepen their acq	uired knowledge in exercises.		
	Students are able to acquire additional knowledge	and to recapitulate poorly understood conte	ent e.g. by using the	video recordings of
	lectures.			
Workload in Hours	·····			
Credit points				
Examination				
Examination duration and scale	120			
Assignment for the Following	General Engineering Science (German program): Specialisa	ation Mechanical Engineering, Focus Energy S	systems: Compulsory	
Curricula	General Engineering Science (German program): Specialisa	ation Mechanical Engineering, Focus Aircraft S	ystems Engineering: C	Compulsory
	General Engineering Science (German program): Specialisa	ation Mechanical Engineering, Focus Materials	in Engineering Scien	ces: Compulsory
	General Engineering Science (German program): Specialisa	• •		
	General Engineering Science (German program): Specialisa			
	General Engineering Science (German program): Specialisa	0 0,	0	0 1 9
	General Engineering Science (German program, 7 semester		-	
	General Engineering Science (German program, 7 seme	ster): Specialisation Mechanical Engineering	g, Focus Materials in	Engineering Science
	Compulsory			
	General Engineering Science (German program, 7 semester	r): Specialisation Mechanical Engineering, Foc	us Mechatronics: Corr	npulsory
	General Engineering Science (German program, 7 semes	ter): Specialisation Mechanical Engineering,	Focus Product Develo	opment and Producti
	Compulsory			
	General Engineering Science (German program, 7 semes	ster): Specialisation Mechanical Engineering,	Focus Theoretical N	lechanical Engineeri
	Compulsory			
	General Engineering Science (German program, 7 semester	r): Specialisation Mechanical Engineering, Foc	us Biomechanics: Cor	mpulsory
	General Engineering Science (German program, 7 semester	r): Specialisation Mechanical Engineering, Foc	us Energy Systems: C	Compulsory
	General Engineering Science (English program): Specialisa	tion Mechanical Engineering, Focus Energy S	ystems: Compulsory	
	General Engineering Science (English program): Specialisa	tion Mechanical Engineering, Focus Aircraft Sy	stems Engineering: C	compulsory
	General Engineering Science (English program): Specialisa	tion Mechanical Engineering, Focus Materials	in Engineering Science	ces: Compulsory
	General Engineering Science (English program): Specialisa	tion Mechanical Engineering, Focus Mechatro	nics: Compulsory	
		tion Mechanical Engineering, Focus Product D	evelopment and Prod	luction: Compulsory
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program): Specialisa General Engineering Science (English program): Specialisa	tion Mechanical Engineering, Focus Theoretic	ai Mechanicai Engine	ering: Compulsory
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	General Engineering Science (English program): Specialisa): Specialisation Mechanical Engineering, Foc	us Aircraft Systems En	gineering: Compulso
	General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Foc	us Aircraft Systems En	gineering: Compulso
	General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 seme): Specialisation Mechanical Engineering, Foc ster): Specialisation Mechanical Engineering	us Aircraft Systems En g, Focus Materials in	gineering: Compulso Engineering Science
	General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 seme Compulsory): Specialisation Mechanical Engineering, Foc ster): Specialisation Mechanical Engineering): Specialisation Mechanical Engineering, Foc	us Aircraft Systems En g, Focus Materials in us Mechatronics: Com	gineering: Compulso Engineering Scienc pulsory
	General Engineering Science (English program): Specialisa General Engineering Science (English program, 7 semester General Engineering Science (English program, 7 seme Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Foc ster): Specialisation Mechanical Engineering): Specialisation Mechanical Engineering, Foc	us Aircraft Systems En g, Focus Materials in us Mechatronics: Com	gineering: Compulso Engineering Scienc pulsory



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
	a Eurodanantala séde fellouise manhian alamanta.
	Fundamentals of the following machine elements:
	Linear rolling bearings Axes & shafts
	 Axes & shans 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.
	 Dubbel, faschenbuch für den Maschinenbau; Grote, KH., Feldnusen, J.(Hrsg.); Springer-Verlag, aktuelle Auliage. Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
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	haben ferteren i z, een een z, en een en ag, anteen er hanget
	Maschinenelemente - Gestaltung, Berechnung, Anwendung; Haberhauer, H., Bodenstein, F., Springer-Verlag, aktuelle Auflage. Bala#Wetek Maschinenelemente: Wittel H. Muha D. Japasech D. Veßick J. Springer Vieweg aktuelle Auflage.
	 Roloff/Matek Maschinenelemente; Wittel, H., Muhs, D., Jannasch, D., Voßiek, J., Springer Vieweg, aktuelle Auflage.
	Sowie weitere Bücher zu speziellen Themen

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



Course L0262: Advanced Mechanic	al Engineering Design I
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Dieter Krause, Prof. Otto von Estorff
Language	DE
Cycle	WiSe
Content	Advanced Mechanical Engineering Design I & II
	Lecture
	Fundamentals of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	• Seals
	Clutches & brakes
	Belt & chain drives
	Gear drives
	• Epicyclic gears
	Crank drives
	Sliding bearings
	Elements of fluidics
	Exercise
	Calculation methods of the following machine elements:
	Linear rolling bearings
	Axes & shafts
	Clutches & brakes
	Belt & chain drives
	Gear drives
	Epicyclic gears
	Crank gears
	 Sliding bearings
	Calculations of hydrostatic systems (fluidics)
Literature	
	Dubbel, Taschenbuch für den Maschinenbau; Grote, KH., Feldhusen, J.(Hrsg.); Springer-Verlag, aktuelle Auflage.
	Maschinenelemente, Band I-III; Niemann, G., Springer-Verlag, aktuelle Auflage.
	 Maschinen- und Konstruktionselemente; Steinhilper, W., Röper, R., Springer Verlag, aktuelle Auflage.
	Einführung in die DIN-Normen; Klein, M., Teubner-Verlag.
	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



Courses	The Hartick OD	
itle dvanced Mechanical Design Project (L02	Typ Hrs/wk CP 266) 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:	
	a constant de la forma de la forma de la deserva de la deserva de	
	 express the procedure for systematically handling of complex design tasks , 	
	 describe working principles, their use and combination possibilities, 	
	 explain guidelines for designing for function and manufacturing, 	
	 explain advanced use-oriented knowledge of machine elements. 	
Skills	After passing the module, students are able to:	
	analyze complex tasks and develop principle solutions using sketches,	
	convert principle solutions into a detailed design,	
	 use methods to design and solve engineering design tasks systematically and solution-oriented, 	
	 create a technical documentation including all necessary technical drawings to understand the functions of the system, 	
	 document calculations of selected machine elements clearly and in detail. 	
Personal Competence		
Social Competence	After passing the module, students are able to:	
	 present and discuss solutions and technical drawings within groups, 	
	 reflect the own results in the work groups of the course 	
Autonomy	After passing the module, students are able to:	
	independently solve complex design projects, while motivating themselves, acquiring necessary knowledge and selecting appropriate the independently solve complex design projects, while motivating themselves, acquiring necessary knowledge and selecting appropriate	method
	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: Comp	ulsory
	General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compu	lsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Co	mpulso
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and F	'roducti
	Compulsory	
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical En	gineeri
	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: Comp	
	General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Comput	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Co	•
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and F	'roducti
	Compulsory	
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical En	gineer
	Compulsory	



Course L0266: Advanced Machania	
Course L0266: Advanced Mechanic	
	Practical Course
Hrs/wk	
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



				Technische Universität Hamburg
Module M0684: Heat Trans	fer			
Courses				
Title		Тур	Hrs/wk	СР
Heat Transfer (L0458)		Lecture	3	5
Heat Transfer (L0459)		Recitation Section (large)	2	1
Module Responsible	Dr. Andreas Moschallski			
Admission Requirements	none			
Recommended Previous	Technical Thermodynamics I, II and Fluid Dynamics			
Knowledge Educational Objectives	After taking part augeoconfully, at idente have reached the following			
	After taking part successfully, students have reached the following	earning results		
Professional Competence Knowledge	The students are able to			
hitewicage				
	- 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.			
Dereand Competence				
Personal Competence Social Competence	The students are able to discuss in small groups and develop an a	aproach		
Social Competence	The sudents 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	ay. A qualified exchan	ge with other students
	given.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 min			
Assignment for the Following	General Engineering Science (German program): Specialisation M	echanical Engineering, Focus Biomech	anics: Compulsory	
Curricula	General Engineering Science (German program): Specialisation M	echanical Engineering, Focus Energy S	systems: Compulsory	
	General Engineering Science (German program): Specialisation B	omedical Engineering: Compulsory		
	General Engineering Science (German program): Specialisation N	echanical Engineering, Focus Theoretic	al Mechanical Engine	eering: Compulsory
	General Engineering Science (German program, 7 semester): Spe	cialisation Mechanical Engineering, Foo	us Energy Systems: 0	Compulsory
	General Engineering Science (German program, 7 semester): S	pecialisation Mechanical Engineering	Focus Theoretical M	Mechanical Engineerin
	Compulsory			
	General Engineering Science (German program, 7 semester): Spe		npulsory	
	General Engineering Science (English program): Specialisation Bi	0 0 1 9		
	General Engineering Science (English program): Specialisation M	0 0,		
	General Engineering Science (English program): Specialisation M			oring Computer
	General Engineering Science (English program): Specialisation M		-	
	General Engineering Science (English program, 7 semester): Spec General Engineering Science (English program, 7 semester): S			
	Compulsory	pecialisation mechanical Engineering,	nocus meoretical N	vechanicai Engineerir
	General Engineering Science (English program, 7 semester): Spec	ialisation Biomedical Engineering: Com	pulsory	
	Mechanical Engineering: Specialisation Energy Systems: Compute			
	Mechanical Engineering: Specialisation Theoretical Mechanical En	•		

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
	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	



This Typ Hrawk CP Simulation and Design of Mechatronic Systems (1182) Locure 2 2 Simulation and Design of Mechatronic Systems (1182) Roctation Section (turge) 1 2 Module Responsible Prof.1 Uwe Wetlin Roctation Section (turge) 1 2 Module Responsible Prof.1 Uwe Wetlin Roctation Section (turge) 1 2 Module Responsible Firof.1 We Wetlin Roctation Section (turge) 1 2 Module Responsible Firof.1 We Wetlin Rocease	Courses				
Simulation and Design of Mechatronic Systems (1883) Laboratory 1 2 Simulation and Design of Mechatronic Systems (1883) Reclation Section (large) 1 2 Micolule Responsible Roft. Uwe Weilin Reclamented	Title		Тур	Hrs/wk	CP
Binutation and Design of Michalancia Systems (L1823) Relation Section (Lappe) 1 2 Module Responsible Port. Uwe Weltin Include Responsible Non No				2	2
Module Responsible Froi. Uwe Weitin Admission Requirements None Recommended Previous Fundamentals of mechanics, control theory and electrical engineering Knowledge Educational Objectives Amount of the second of the	Simulation and Design of Mechatronic Sys	tems (L1824)	Laboratory	1	2
Admission Requirements Nome Recommended Previous Fundatimentalis of mechanics, control theory and electrical engineering Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge Skilds Students are able to describe methods and calculations for design, modeling, simulation and optimization of mechatronic systems. Skilds Skildents are able to apply modern algorithms for modeling of mechatronic systems. They can identify, simulate and design simple system Budents are able to apply modern algorithms for modeling of mechatronic systems. They can identify, simulate and design simple systems. Skilds Students are able to exploy conditions. Event 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 Examination duration and scate 90 min General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering	Simulation and Design of Mechatronic Sys	tems (L1823)	Recitation Section (large)	1	2
Recommended Previous Fundatmentalis of mechanica, control theory and electrical engineering Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge Skills Students are able to describe methods and calculations for design, modeling, simulation and optimization of mechatronic systems. Skills Students are able to apply modern algorithms for modeling of mechatronic systems. They can identify, simulate and design simple systimplement those in laboratory conditions. Personal Competence Students are able to recognize and improve knowledge deficits independently. With instructor assistance, students are able to recognize and improve knowledge deficits independently. Workload in Hours Independent Study Time in Lecture 56 Credit points 6 Examination duration and scale 90 min Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation M	Module Responsible	Prof. Uwe Weltin			
Knowledge After taking part successfully, students have reached the following learning results Professional Competence Students are able to describe methods and calculations for design, modeling, simulation and opfimization of mechatronic systems. Still Students are able to describe methods and calculations for design, modeling, simulation and opfimization of mechatronic systems. Still Students are able to describe methods and calculations for design, modeling of mechatronic systems. They can identify, simulate and design simple systemplement those in laboratory conditions. Personal Competence Students are able to work goal-oriented in small mixed groups and present results to target groups. Autonom 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 I Houm Independent Study Time 124, Study Time in Lecture 56 Credit pointa 6 Examination duration and scale 90 min General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General	Admission Requirements	None			
Professional Competence Students are able to describe methods and calculations for design, modeling, simulation and optimization of mechatronic systems. Skills Students are able to apply modern algorithms for modeling of mechatronic systems. They can identify, simulate and design simple systimplement those in laboratory conditions. Personal 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. Within instructor assistance, students are able to evaluate their own knowledge level and define a further course of study. Morkload 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 Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineerin		Fundatmentals of mechanics, control theory and electric	cal engineering		
Knowledge Students are able to describe methods and calculations for design, modeling, simulation and optimization of mechatronic systems. Skills Students are able to apply modern algorithms for modeling of mechatronic systems. They can identify, simulate and design simple systemplement those in laboratory conditions. Personal 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 own knowledge level and define a further course of study. Workload in Hours IndependentStudy Time 124, Study Time in Lecture 56 Credit points 90 min Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus 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): Specialisation Mechanical Engineering, Focus Mechatronics: C	Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Skills Students are able to apply modern algorithms for modeling of mechatronic systems. They can identify, simulate and design simple systimplement those in laboratory conditions. Personal 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 own knowledge level and define a further course of study. Workload in Hours Independent Study Time in Lecture 56 Credit pointe 6 Examination Written exam Examination Written exam General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Co	Professional Competence				
Implement those in laboratory conditions. Implement those in laboratory conditions. 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 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 duration and scab 90 min Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Micratt Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircratt Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircratt Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircratt Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircratt Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English prog	Knowledge	Students are able to describe methods and calculations	s for design, modeling, simulation and optimization	of mechatronic syster	ns.
Social Competence Students are able to work goal-oriented in small mixed groups and present results to target groups. Autonom 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. Morkload in Hours Independent Study Time 124, Study Time in Lecture 56 Credit points 6 Examination duration and seale 90 min Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Micraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanica	Skills		odeling of mechatronic systems. They can ident	ify, simulate and des	sign simple systems ar
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 point 6 Examination duration and scale 90 min Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus 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 Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus		Students are able to work goal-oriented in small mixed	aroups and present results to target groups.		
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 Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Congeneral Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program, 7					
Credit points 6 Examination Written exam Examination duration and scale 90 min Assignment for the Following General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Atricraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Atricraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Atricraft Systems Engineering: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Atricraft Systems Engineeri		With instructor assistance, students are able to evaluate	e their own knowledge level and define a further co	urse of study.	
Examination Written exam Examination duration and scale 90 min Assignment for the Following Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): 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 Mechatronics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory	Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Examination duration and scale 90 min Assignment for the Following Curricula General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (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 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 Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering:	Credit points	6			
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Mechanical Engineering: Specialisation Mechatronics: Compulsory					
Mechanical Engineering: Specialization Theoretical Mechanical Engineering: Compulsory					
Mechatronics: Core qualification: Compulsory		· ·	chanical Engineering: Compulsory		

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



Course L1824: Simulation and Desig	of Mechatronic Systems	
Тур	Laboratory	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	
Course L1823: Simulation and Desig	gn of Mechatronic Systems	
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Lecturer	Prof. Uwe Weltin	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

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



Courses	es IV				
ïtle		Тур		Hrs/wk	CP
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)		Recitation	Section (large)	1	1
Module Responsible	Prof. Anusch Taraz				
Admission Requirements	none				
	Mathematics 1 - III				
Knowledge					
	After taking part successfully, students have reache	ed the following learning results			
Professional Competence					
Knowledge	 Students can name the basic concepts in M 	lathomatics IV. They are able to ex-		ropriato oxamplos	
	 Students can hame the basic concepts in it Students can discuss logical connections b 				th the help of example
	They know proof strategies and can reprod		apable of musicating	lifese connections wit	in the help of example
	 They know proof strategies and can reprod 	Joe mem.			
Skills	Students can model problems in Mathemati	ics IV with the help of the concepts	studied in this cours	se. Moreover, they are	capable of solving th
	by applying established methods.			· · · · · , · · , · · · ,	
	 Students are able to discover and verify fur 	ther logical connections between th	e concepts studied ir	n the course.	
	 For a given problem, the students can deve 	•	•		sults.
	· · · · · · · · · · · · · · · · · · ·		.,		
Personal Competence					
Personal Competence					
Social Competence	Students are able to work together in teams	. They are capable to use mathem?	atics as a common la	nguage.	
	 In doing so, they can communicate new co 				can design example
	check and deepen the understanding of the				
A to a o mu					
Autonomy	Students are capable of checking their und	derstanding of complex concepts o	n their own. They ca	an specify open quest	ions precisely and kr
	where to get help in solving them.				
	 Students have developed sufficient persister 	ence to be able to work for longer p	eriods in a goal-orien	nted manner on hard p	roblems.
			-		
Workload in Hours	Independent Study Time 68, Study Time in Lecture	112			
Credit points	Written exam				
Examination					
Examination Examination duration and scale	60 min (Complex Functions) + 60 min (Differential	. ,			
Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program):	Specialisation Electrical Engineerin			
Examination Examination duration and scale	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program):	Specialisation Electrical Engineerin Specialisation Mechanical Enginee	ring, Focus Mechatro		
Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program):	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee	ring, Focus Mechatro ring, Focus Theoretic		eering: Compulsory
Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program):	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee	ring, Focus Mechatro ring, Focus Theoretic		eering: Compulsory
Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program, 7	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee Specialisation Naval Architecture: C 'semester): Specialisation Electrica	ring, Focus Mechatro ring, Focus Theoretic Compulsory Il Engineering: Comp	cal Mechanical Engine	
Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program, 7 General Engineering Science (German program, 7	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee Specialisation Naval Architecture: C 'semester): Specialisation Electrica 'semester): Specialisation Mechani	ring, Focus Mechatro ring, Focus Theoretic Compulsory Il Engineering: Comp ical Engineering, Foc	cal Mechanical Engine pulsory cus Mechatronics: Con	npulsory
Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program, 7	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee Specialisation Naval Architecture: C 'semester): Specialisation Electrica 'semester): Specialisation Mechani	ring, Focus Mechatro ring, Focus Theoretic Compulsory Il Engineering: Comp ical Engineering, Foc	cal Mechanical Engine pulsory cus Mechatronics: Con	npulsory
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Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program); General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program Compulsory	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee Specialisation Naval Architecture: C ' semester): Specialisation Electrica ' semester): Specialisation Mechani , 7 semester): Specialisation Naval Ar	ring, Focus Mechatro ring, Focus Theoretic Compulsory Il Engineering: Comp ical Engineering, Foc hanical Engineering,	cal Mechanical Engine oulsory cus Mechatronics: Con I, Focus Theoretical M	npulsory
Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program); General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program Compulsory General Engineering Science (German program, 7	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee Specialisation Naval Architecture: C ' semester): Specialisation Electrica ' semester): Specialisation Mechani , 7 semester): Specialisation Mechani ' semester): Specialisation Naval Ar Mathematics: Elective Compulsory	ring, Focus Mechatro ring, Focus Theoretic Compulsory Il Engineering: Comp ical Engineering, Foc hanical Engineering,	cal Mechanical Engine oulsory cus Mechatronics: Con I, Focus Theoretical M	npulsory
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Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program Compulsory General Engineering Science (German program, 7 Computer Science: Specialisation Computational I Electrical Engineering: Core qualification: Computer	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee Specialisation Naval Architecture: C ' semester): Specialisation Electrica ' semester): Specialisation Mechani , 7 semester): Specialisation Mechani , 7 semester): Specialisation Naval Ar Mathematics: Elective Compulsory sory Specialisation Electrical Engineering	ring, Focus Mechatro ring, Focus Theoretic Compulsory Il Engineering: Comp ical Engineering, Foc hanical Engineering, rchitecture: Compulso g: Compulsory	cal Mechanical Engine oulsory cus Mechatronics: Con I, Focus Theoretical M	npulsory
Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program, 7 General Engineering Science (German program, 7 General Engineering Science (German program Compulsory General Engineering Science (German program, 7 Computer Science: Specialisation Computational I Electrical Engineering: Core qualification: Comput General Engineering: Science (English program): S	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee Specialisation Naval Architecture: C 'semester): Specialisation Electrica 'semester): Specialisation Mechani , 7 semester): Specialisation Meck 'semester): Specialisation Naval Ar Mathematics: Elective Compulsory sory Specialisation Electrical Engineerin Specialisation Naval Architecture: C	ring, Focus Mechatro ring, Focus Theoretic Compulsory Il Engineering: Comp ical Engineering, Foc hanical Engineering, rchitecture: Compulso g: Compulsory ompulsory	cal Mechanical Engine oulsory cus Mechatronics: Con I, Focus Theoretical M ory	npulsory
Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program, 7 General Engineering Science (German program, 7 Compulsory General Engineering Science (German program, 7 Computer Science: Specialisation Computational I Electrical Engineering Science (English program): § General Engineering Science (English program): §	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee Specialisation Naval Architecture: C 'semester): Specialisation Mechani , 7 semester): Specialisation Mechani , 7 semester): Specialisation Naval Ar Mathematics: Elective Compulsory sory Specialisation Electrical Engineerin Specialisation Naval Architecture: C Specialisation Mechanical Engineer	ring, Focus Mechatro ring, Focus Theoretic Compulsory Il Engineering: Comp ical Engineering, Foc hanical Engineering, rchitecture: Compulso g: Compulsory ompulsory ring, Focus Mechatron	cal Mechanical Engine oulsory cus Mechatronics: Con I, Focus Theoretical M ory	npulsory Aechanical Engineer
Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program, 7 General Engineering Science (German program, 7 Compulsory General Engineering Science (German program, 7 Computer Science: Specialisation Computational I Electrical Engineering Science (English program): § General Engineering Science (English program): § General Engineering Science (English program): §	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee Specialisation Naval Architecture: C semester): Specialisation Electrica 'semester): Specialisation Mechani , 7 semester): Specialisation Mech 'semester): Specialisation Naval Ar Mathematics: Elective Compulsory sory Specialisation Electrical Engineerin Specialisation Naval Architecture: C Specialisation Mechanical Engineer Specialisation Mechanical Engineer	ring, Focus Mechatro ring, Focus Theoretic Compulsory Il Engineering: Comp ical Engineering, Foc hanical Engineering, rchitecture: Compulso g: Compulsory ompulsory ring, Focus Mechatro ring, Focus Theoretic	cal Mechanical Engine oulsory cus Mechatronics: Con h, Focus Theoretical M ory onics: Compulsory cal Mechanical Engine	npulsory Aechanical Engineer
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Examination Examination duration and scale Assignment for the Following	60 min (Complex Functions) + 60 min (Differential General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program): General Engineering Science (German program, 7 General Engineering Science (German program, 7 Computer Science: Specialisation Computational I Electrical Engineering Science (English program): General Engineering Science (English program, 7 General Engineering Science (English program, 7 Computational Science and Engineering: Speciali Computational Science and Engineering: Speciali Mechanical Engineering: Specialisation Theoretic	Specialisation Electrical Engineerin Specialisation Mechanical Enginee Specialisation Mechanical Enginee Specialisation Naval Architecture: C 'semester): Specialisation Electrica 'semester): Specialisation Mechani , 7 semester): Specialisation Mechani , 7 semester): Specialisation Naval Ar Mathematics: Elective Compulsory sory Specialisation Electrical Engineerin Specialisation Mechanical Engineerin Specialisation Mechanical Engineerin Specialisation Mechanical Engineeri semester): Specialisation Mechanical semester): Specialisation Mechanical semester): Specialisation Mechanical 7 semester): Specialisation Mechanical semester): Specialisation Mechanical semester): Specialisation Mechanical computer Sciences: Elective sation Computer Sciences: Elective (al Mechanical Engineering: Compu nics: Compulsory	ring, Focus Mechatro ring, Focus Theoretic Compulsory Il Engineering: Comp ical Engineering, Foc hanical Engineering, Foc hanical Engineering, rchitecture: Compulsory ompulsory ring, Focus Mechatro ring, Focus Mechatro ring, Focus Mechatro ring, Focus Mechatro ring, Focus Theoretics I Engineering: Compulso cal Engineering, Focu hanical Engineering, chitecture: Compulso ve Compulsory Compulsory	cal Mechanical Engine oulsory cus Mechatronics: Com , Focus Theoretical M ory onics: Compulsory cal Mechanical Engine ulsory cus Mechatronics: Com , Focus Theoretical M	npulsory Aechanical Engineer ering: Compulsory Ipulsory



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

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

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

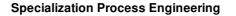
Course L1038: Complex Functions	
Тур	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	Main features of complex analysis
	 Functions of one complex variable Complex differentiation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



Course L1041: Complex Functions	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course
Course L1042: Complex Functions	
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14

Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

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Module M0886: Fundament	als of Process Engineering			
module modol. I unuament				
Courses				
Title		Тур	Hrs/wk	CP
Introduction into Process Engineering/Biop	process Engineering (L0829)	Lecture	2	1
Fundamentals 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 reache	ed the following learning results		
Professional Competence				
Knowledge	After passing this module the students have the ab	ility to:		
	 give an overview of the most important field 	s on process and bioprocess engineering		
	 explain some working methods for different 			
		······································		
Skills	After passing this module the students should have	e the ability to:		
	 list and outline the most important fields of p 	process engineering,		
	 name the most important working approach 	es or methods of the different fields of process engir	neering,	
	 read and prepare an engineering drawing, 			
	explain the most important technologies for	wastewater and exhaust air treatment		
	 scheme typical chemical and biotechnologi 	cal processes independently with the aid of pointers	i.	
Personal Competence				
Social Competence	The students are able to			
oocial oompetence				
	 work out results in groups and document th 	em,		
	 provide appropriate feedback and handle feedback 	eedback on their own performance constructively.		
Autonomy	The students are able to estimate their progress	of learning by themselves and to deliberate their	lack of knowledge in P	rocess Engineering and
	Bioprocess Engineering.	· · · · · · · · · · · · · · · · · · ·		J -
Workload in Hours	Independent Study Time 34, Study Time in Lecture	56		
Credit points	3			
Examination				
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program):			
Curricula		Specialisation Bioprocess Engineering: Compulsory		
		semester): Specialisation Process Engineering: Co		
		semester): Specialisation Bioprocess Engineering:	Compulsory	
	Bioprocess Engineering: Core qualification: Comp			
		Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): S			
		semester): Specialisation Process Engineering: Cor		
		semester): Specialisation Bioprocess Engineering: (Jompulsory	
	Process Engineering: Core qualification: Compulse	yic		

Course L0829: Introduction into Pro	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	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Marko Hoffmann
Language	DE
Cycle	WiSe
Content	 Introduction Atomic structure and bonding Structure of solids Miller indices Imperfections in solids Texture Diffusion Mechanical properties Dislocations and strengthening mechanisms Phase transformations Phase diagrams, iron-carbon phase diagram Metallic materials Corrosion Polymeric materials Ceramic materials
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 for	engineers and mathematics I-III.		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	The students are able,			
	-to repeat the basic concepts of physical chemistry			
	-to describe and summarize the underlying concepts of mass-, he	at- and momentum transfer.		
	- to interpret phase diagrams and affiliate kinetic rate laws.			
Skills	The students are able to			
	- conduct (fundamental) thermodynamical, electrochemical and ki	netic calculations.		
	- assess new applications with respect to environmental sustaina	bility.		
	- abstract their knowldege to related issues to conduct thermodyna	amical, electrochemical and kinetic cal	culations.	
Personal Competence				
Social Competence	The students are able to plan, prepare, conduct and document exp	periments according to scientific guide	lines in small groups.	
	The students are able to reflect their subject-specific knowledge o	rally in a team and to discuss it with fe	llow students and faculty	
Autonomy	Students are able to assess their knowldege continuously on the	r own by exemplified practice. Studen	ts are able to apply their	knowldege discretely to
	plan, prepare and conduct experiments.			
Workload in Hours	Independent Study Time 34, Study Time in Lecture 56			
Credit points	3			
Examination	Written exam			
Examination duration and scale	180 min			
Assignment for the Following	General Engineering Science (German program): Specialisation I	Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation I	Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Spe	ecialisation Process Engineering: Con	npulsory	
	General Engineering Science (German program, 7 semester): Spe	ecialisation Bioprocess Engineering: E	lective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compulsory			
	General Engineering Science (English program): Specialisation P	rocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisation E	ioprocess Engineering: Compulsory		
	General Engineering Science (English program, 7 semester): Spe	cialisation Process Engineering: Com	pulsory	
	General Engineering Science (English program, 7 semester): Spe	cialisation Bioprocess Engineering: E	lective 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

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



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



Module M0536: Fundament	als of Fluid Mechanics			
Courses				
Title		Тур	Hrs/wk	CP
Fundamentals of Fluid Mechanics (L0091)		Lecture	2	4
Fluid Mechanics for Process Engineering	(L0092)	Recitation Section (large)	2	2
Module Responsible	Prof. Michael Schlüter			
Admission Requirements	None			
Recommended Previous	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 followin	g learning results		
Professional Competence				
Knowledge	Students are able to:			
	 explain the difference between different types of flow give an overview for different applications of the Reynold: 	Transport Theorem in process onginee	ring	
	 explain simplifications of the Continuity- and Navier-Stoke 		•	
Skills	The students are able to			
	 describe and model incompressible flows mathematically 			
	 reduce the governing equations of fluid mechanics by sin 		ons e.g. by integration	
	notice the dependency between theory and technical app	lications		
	 use the learned basics for fluid dynamical applications in 	fields of process engineering		
Personal Competence				
Social Competence	The students			
, , ,				
	are capable to gather information from subject related, pro			
	 able to work together on subject related tasks in small gro exercises) 	oups. They are able to present their result	ts effectively in English	(e.g. during small gro
	 are able to work out solutions for exercises by themselves 	, to discuss the solutions orally and to pro-	esent the results.	
		,		
Autonomy	The students are able to			
	 search further literature for each topic and to expand their 	knowledge with this literature,		
	 work on their exercises by their own and to evaluate their 			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale Assignment for the Following	3 hours			
Curricula	General Engineering Science (German program): Specialisation General Engineering Science (German program): Specialisation			
Garriella	General Engineering Science (German program): Specialisation	1 0 0 1 ,	Compulsory	
	General Engineering Science (German program, 7 semester): Sp			
	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	ngineering: Compulsor	/
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Com			
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program): Specialisation		ompulsory	
	General Engineering Science (English program): Specialisation		leon	
	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			
	Technomathematics: Specialisation III. Engineering Science: Ele		5 ··· 5 ····	
	Process Engineering: Core qualification: Compulsory			



Tvp	Lecture
Hrs/wk	
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Prof. Michael Schlüter
Language	
Cycle	505e
Content	fluid properties
	hydrostatic
	overall balances - theory of streamline
	overall balances- conservation equations
	differential balances - Navier Stokes equations
	irrotational flows - Potenzialströmungen
	 flow around bodies - theory of physical similarity
	turbulent flows
	compressible flows
Literature	
	1. Crowe, C. T.: Engineering fluid mechanics. Wiley, New York, 2009.
	2. Durst, F.: Strömungsmechanik: Einführung in die Theorie der Strömungen von Fluiden. Springer-Verlag, Berlin, Heidelberg, 2006.
	3. Fox, R.W.; et al.: Introduction to Fluid Mechanics. J. Wiley & Sons, 1994
	4. Herwig, H.: Strömungsmechanik: Eine Einführung in die Physik und die mathematische Modellierung von Strömungen. Springer Verlag, Ber
	Heidelberg, New York, 2006
	 Herwig, H.: Strömungsmechanik: Einführung in die Physik von technischen Strömungen: Vieweg+Teubner Verlag / GWV Fachverlage Gmt Wiesbaden, 2008
	6. Kuhlmann, H.C.: Strömungsmechanik. München, Pearson Studium, 2007
	7. Oertl, H.: Strömungsmechanik: Grundlagen, Grundgleichungen, Lösungsmethoden, Softwarebeispiele. Vieweg+ Teubner Verlag / Gl
	Fachverlage GmbH, Wiesbaden, 2009
	8. Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007
	 Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Ber Heidelberg, 2008
	10. Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006
	11. van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882.
	12. White, F.: Fluid Mechanics, Mcgraw-Hill, ISBN-10: 0071311211, ISBN-13: 978-0071311212, 2011

Course L0092: Fluid Mechanics for F	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
	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 Fachverlag / GWV Fachverlage GmbH, Wiesbaden, 2009 Schade, H.; Kunz, E.: Strömungslehre. Verlag de Gruyter, Berlin, New York, 2007 Truckenbrodt, E.: Fluidmechanik 1: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide. Springer-Verlag, Berlin, Heidelberg, 2008 Schlichting, H.: Grenzschicht-Theorie. Springer-Verlag, Berlin, 2006 van Dyke, M.: An Album of Fluid Motion. The Parabolic Press, Stanford California, 1882.



Module M0544: Phase Equ	ilibria Thermodynamics			
Courses				
Title		Тур	Hrs/wk	CP
Thermodynamics III (L0114)		Lecture	2	2
Thermodynamics III (L0140)		Recitation Section (small)	1	2
Thermodynamics III (L0142)		Recitation Section (large)	1	2
Module Responsible	Prof. Irina Smirnova	(0)		
Admission Requirements	None			
Recommended Previous Knowledge	Mathematics, Physical Chemistry, Thermodynamics I and II			
Educational Ohiostinas	Adverte Line westernesses fully, students being von stand the following			
Educational Objectives Professional Competence	After taking part successfully, students have reached the followin	g learning results		
Knowledge	 Starting from the very basics of thermodynamics, the stud They learn how state variables are influenced by the mixi Moreover, the students learn how phase equilibria can be liquid, solid) coexist in equilibrium. Furthermore the funda For different phase equilibria, several examples relevant interpreting the equilibria are taught. 	ng of compounds and learn concepts to q e described mathematically and which ph mentals of reaction equilibria are taught.	uantitatively describe enomena may occur	these properties. if different phases (vap
Skills	 Applying their knowledge, the students are able to ident simplify these equations meaningfully. The students know models which can be used to determ resulting mathematical relations. For specific applications, they are able to self-reliantly fin literature sources. Beside pure compound properties the students are capate. The students know how to visualize phase equilibria grapt. Based on their knowledge, the students are able to ur processes in chemical engineering. 	ine the properties of the system in the e d necessary physico-chemical properties le of describing the properties of mixtures hically and they know how to interpret the	quilibrium state and t of compounds as we s. e occurring phenomer	hey are able to solve t Il as model parameters na.
Personal Competence				
Social Competence	The students are able to work in small groups, to solve the correst	ponding problems and to present them o	raly to the tutors and o	other students
Autonomy	 The students are able to find necessary information self-response to buring the semester the students are able to check their adept their learning process. 			wledge the students o
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 minutes; theoretical questions and calculations			
Assignment for the Following	General Engineering Science (German program): Specialisation	Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation	Bioprocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Sp	ecialisation Process Engineering: Comp	ulsory	
	General Engineering Science (German program, 7 semester): Sp			
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation	Bioprocess Engineering: Compulsorv		
	General Engineering Science (English program): Specialisation			
	General Engineering Science (English program, 7 semester): Sp		llsory	
	General Engineering Science (English program, 7 semester): Sp	ecialisation bioprocess Lingineening. Cor	iipuisoiy	



Owners 10444 Thomas have a set	
Course L0114: Thermodynamics III	
Тур	
Hrs/wk	
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	SoSe
Content	
	 Introduction: Applications of thermodynamics of mixtures Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule Equations of state: virial equations, van-der-Waals equation, generalized equations of state Mixing properties: ideal and real mixtures, excess properties, partial molar properties Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition Gas-liquid-equilibria: equilibrium condition, Henry-coefficient G^E-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNIQUAC, UNIFAC Liquid-liquid-equilibria: equilibrium condition, phase equilibria in binary and ternary systems Solid-liquid-equilibria: equilibrium condition, binary systems Chemical reactions: reaction coordinate, mass action law, influence of pressure and temperature Osmotic pressure
Literature	 Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997.J.P. O'Connell, J.M. Haile: Thermodynamics. Cambridge University Press, 2005.

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
Literature	 Introduction: Applications of thermodynamics of mixtures Thermodynamic equations in multi-component systems: Fundamental equations, chemical potential, fugacity Phase equilibria of pure substances: thermodynamic equilibrium, vapor pressure, Gibbs' phase rule Equations of state: virial equations, van-der-Waals equation, generalized equations of state Mixing properties: ideal and real mixtures, excess properties, partial molar properties Vapor-liquid-equilibria: binary systems, azeotropes, equilibrium condition Gas-liquid-equilibria: equilibrium condition, Henry-coefficient G^E-Models: Hildebrand-model, Flory-Huggins-model, Wilson-model, UNICUAC, 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 The students work on tasks in small groups and present their results in front of all students. Jürgen Gmehling, Bärbel Kolbe: Thermodynamik. VCH 1992 J.M. Prausnitz, R.N. Lichtenthaler, E.G. de Azevedo: Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed. Prentice Hall, 1999. J.W. Tester, M. Modell: Thermodynamics and its Applications. 3rd ed. Prentice Hall, 1997, J.P. O'Connell, J.M. Haile: Thermodynamics. Cambridge University Press, 2005.



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



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 systems. Good knowledge in maths as covere Further experience with spectral transformations (Fourier series, Fourier transform, Laplace transform) is u		
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 methor to apply the fundamental transformations of continuous-time and discrete-time signals and systems. They and systems mathematically in both time and image domain. In particular, they understand the effects caused by the transition of a continuous-time signal to a discrete-time signal.	can describe and anal in time domain and i	lyse deterministic sigr mage domain which
Skills	The students are able to describe and analyse deterministic signals and linear time-invariant systems us can analyse and design basic systems regarding important properties such as magnitude and phase resist 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 con-	trol their level of know	vledge during the lect
	period by solving tutorial problems, software tools, clicker system.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Examination	Written exam		
Examination duration and scale	90 min		
Assignment for the Following	General Engineering Science (German program): Specialisation Electrical Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Computer Science: Compulsory		
	General Engineering Science (German program): Specialisation Process Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisation Civil- and Enviromental Engeneering: Co	ompulsory	
	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	oulcon	
	General Engineering Science (German program, 7 semester): Specialisation Electrical Engineering. Comp General Engineering Science (German program, 7 semester): Specialisation Computer Science: Computer		
	General Engineering Science (German program, 7 semester): Specialisation Computer Science: Computer General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Comp		
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Con		
	General Engineering Science (German program, 7 semester): Specialisation Biomedical Engineering: Co		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Fo		mpulsory
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Fo		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Fo General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineerin Compulsory		
	General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Fo General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering Compulsory		
	Computer Science: Core qualification: Compulsory		
	Electrical Engineering: Core qualification: Compulsory General Engineering Science (English program): Specialisation Civil- and Enviromental Engeneering: Co	muleory	
	General Engineering Science (English program): Specialisation Civil- and Environmental Engeneering: Co General Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory	mpuloory	
	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: Comp	-	
	General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compuls:	-	
	General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compu General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Corr		
	General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Cor General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Cor		
	General Engineering Science (English program, 7 semester): Specialisation Dometical Engineering, For		mpulsorv
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Foc		
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Foc	cus Aircraft Systems Er	ngineering: Compulso
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering Compulsory	g, Focus Materials ir	n Engineering Scien
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Foc	cus Mechatronics: Con	npulsory
	General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering		
	Compulsory		
	Computational Science and Engineering: Core qualification: Compulsory Mechatronics: Core qualification: Compulsory		



Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

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

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



Courses				
Title		Тур	Hrs/wk	CP
Bioprocess Engineering - Fundamentals (L		Lecture	2	3
Bioprocess Engineering- Fundamentals (L Bioprocess Engineering - Fundamental Pra		Recitation Section (large) Laboratory Course	2	1 2
	Prof. Andreas Liese	Laboratory Course	2	2
Admission Requirements	none			
Recommended Previous	none, module "organic chemistry", module "fundamentals for	r process engineering"		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follo	owing learning results		
Professional Competence Knowledge				
	 describe different kinetic approaches for growth and substrate-uptake and to calculate the corresponding parameters predict qualitatively the influence of energy generation, regeneration of redox equivalents and growth inhibition on the fermentation processes analyze bioprocesses on basis of stoichiometry and to set up / solve metabolic flux equations distinguish between scale-up criteria for different bioreactors and bioprocesses (anaerobic, aerobic as well as microaerobic) to compare well as to apply them to current biotechnical problem propose solutions to complicated biotechnological problems and to deduce the corresponding models to explore new knowledge resources and to apply the newly gained contents identify scientific problems with concrete industrial use and to formulate solutions. to document and discuss their procedures as well as results in a scientific manner 			
Personal Competence Social Competence Autonomy	After completion of this module participants should be able own opinions and increase their capacity for teamwork in en-	gineering and scientific environments.		
	y After completion of this module participants will be able to solve a technical problem in a team independently by organizing their workflow and present their results in a plenum.		· · · · · · · · · · · · · · · · · · ·	
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	n Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisa	ation Process Engineering: Compulsory		
Curricula				
	General Engineering Science (German program, 7 semester			
	General Engineering Science (German program, 7 semester	r): Specialisation Bioprocess Engineering: Co	mpulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisat			
	General Engineering Science (English program): Specialisat			
			lisory	
	General Engineering Science (English program, 7 semester)			
	General Engineering Science (English program, 7 semester)): Specialisation Bioprocess Engineering: Cor		
	General Engineering Science (English program, 7 semester) Biomedical Engineering: Specialisation Artificial Organs and): Specialisation Bioprocess Engineering: Cor Regenerative Medicine: Compulsory		
	General Engineering Science (English program, 7 semester) Biomedical Engineering: Specialisation Artificial Organs and Biomedical Engineering: Specialisation Implants and Endop	: Specialisation Bioprocess Engineering: Cor Regenerative Medicine: Compulsory rostheses: Elective Compulsory		
	General Engineering Science (English program, 7 semester) Biomedical Engineering: Specialisation Artificial Organs and Biomedical Engineering: Specialisation Implants and Endop Biomedical Engineering: Specialisation Medical Technology	: Specialisation Bioprocess Engineering: Cor Regenerative Medicine: Compulsory rostheses: Elective Compulsory and Control Theory: Elective Compulsory		
	General Engineering Science (English program, 7 semester) Biomedical Engineering: Specialisation Artificial Organs and Biomedical Engineering: Specialisation Implants and Endop	: Specialisation Bioprocess Engineering: Cor Regenerative Medicine: Compulsory rostheses: Elective Compulsory and Control Theory: Elective Compulsory usiness Administration: Elective Compulsory		



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

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

Course L0843: Bioprocess Engineering - Fundamental Practical Course		
Тур	Laboratory Course	
Hrs/wk	2	
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 M0891: Informatics	for Process Engineers			
Courses				
Title		Тур	Hrs/wk	CP
Informatics for Process Engineers (L0836	i)	Lecture	2	2
Informatics for Process Engineers (L0837)	Recitation Section (small)	2	2
Numeric and Matlab (L0125)		Laboratory Course	2	2
Module Responsible	Dr. Marcus Venzke			
Admission Requirements	None.			
Recommended Previous	Basic knowledge in using MS Windows.			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following	learning results		
Professional Competence				
Knowledge	Students can describe procedural and object-oriented concepts.			
Skills Personal Competence Social Competence	Students are capable of object-oriented programming in the programing language Java and of solving mathematic questions by using Matlab. Students are capable of developing concepts (simple algorithms) to solve technical questions. Students are able to work out solutions together in small groups.			
Autonomy	-			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following	General Engineering Science (German program): Specialisation P	rocess Engineering: Elective Compuls	ory	
Curricula	General Engineering Science (German program, 7 semester): Spec	cialisation Energy and Enviromental E	ngineering: Elective Co	ompulsory
	General Engineering Science (German program, 7 semester): Spec	cialisation Process Engineering: Electi	ve Compulsory	
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compu	Ilsory		
	General Engineering Science (English program): Specialisation Pr	ocess Engineering: Elective Compulso	ory	
	General Engineering Science (English program, 7 semester): Spec	ialisation Energy and Enviromental Er	igineering: Elective Co	ompulsory
	General Engineering Science (English program, 7 semester): Spec	ialisation Process Engineering: Electiv	e Compulsory	
	Process Engineering: Core qualification: Compulsory			



Course L0836: Informatics for Proce		
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	
	Bioliotiek: 11/17	
	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	
	Java Platiorm, Standard Edition / APT Specification http://docs.oracle.com/javase/7/docs/api/	
	ntps/ddds.oradie.com/javase///ddds/ap//	



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



Module M1274: Environme	ntal Technology			
Courses				
Title		Тур	Hrs/wk	CP
Environmental Assessment (L0860)		Lecture	2	2
Environmental Assessment (L1054)		Recitation Section (small)	1	1
Module Responsible	Prof. Martin Kaltschmitt			
Admission Requirements	None			
Recommended Previous	Fundamentals of inorganic/organic chemistry and biology			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the follo	owing learning results		
Professional Competence	· · · · · · · · · · · · · · · · · · ·			
Knowledge	With the completion of this module the students acquire in-d	enth knowledge of important cause-effect ch	nains of potential envir	onmental problems wh
Kilowicage	might occur from production processes, projects or construct			
	in dealing with different methods and instruments to assess			
	environmental processes as well as uncertainties and difficu			to the complexity of the
Skills	The students are able to select a suitable method for the re		ent methods. Thereby t	they can develop suita
okino -	solutions for managing and mitigating environmental prob			
	independently and can apply the software programs OpenL0			
	to critically judge research results or other publications on er			
Personal Competence				
Social Competence	The students are able to discuss the various technical and	scientific tasks, both subject-specific and m	ultidisciplinary. They a	are able to develop joi
	different solutions and to discuss their theoretical or practical implementation. Due to the selected lecture topics, the students receive insights into the			
	multi-layered issues of the environment protection and the	concept of sustainability. Their sensitivity	and consciousness to	wards these subjects
	raised and which helps to raise their awareness of their futur	e social responsibilities in their role as engir	neers.	
Autonomy	The students learn to research, process and present a scie solve an environmental problem in a business context and a			t scientific work. They
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Examination	Written exam			
Examination duration and scale	1 hour written exam			
Assignment for the Following	General Engineering Science (German program): Specialisa	tion Energy and Enviromental Engineering:	Compulsory	
Curricula	General Engineering Science (German program): Specialisa	ation Process Engineering: Elective Compuls	sory	
	General Engineering Science (German program, 7 semester	r): Specialisation Energy and Enviromental E	ingineering: Compulso	ory
	General Engineering Science (German program, 7 semester	r): Specialisation Process Engineering: Elect	ive Compulsory	
	General Engineering Science (German program, 7 semester	r): Specialisation Bioprocess Engineering: El	ective Compulsory	
	Bioprocess Engineering: Core qualification: Elective Compu	•		
	Energy and Environmental Engineering: Core qualification:			
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program): Specialisa			
	General Engineering Science (English program, 7 semester			ry
	General Engineering Science (English program, 7 semester			
	General Engineering Science (English program, 7 semester		ective Compulsory	
	Process Engineering: Core qualification: Elective Compulso	ry		
	Process Engineering: Core 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



Module M0538: Heat and M	lass Transfer			
Courses			Hara forde	
Fitle Heat and Mass Transfer (L0101)	Ty	/p acture	Hrs/wk 2	CP 4
Heat and Mass Transfer (L0101)		ecitation 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 learning res	ults		
Professional Competence				
Knowledge Skills	 The students are capable of explaining qualitative and determining of chemical reactors). They are capable of distinguish and characterize different kinds of hear adiation. The students have the ability to explain the physical basis for mass transfer using suitable mass transfer theories. They are able to depict the analogy between heat- and mass transfer and the stransfer and the strans	at transfer mechanisms nar nsfer in detail and to descri nd to describe complex link en transport problem by us d chemical reactors, tempo technical processes or app sition and mass transfer. The damental types of heat a processes in procedural app this course with knowleg	mely heat conduction, h ibe mass transfer qualit ked processes in detail. sing the gained knowle erature alteration in flui paratus. 'hey can use this knowl and mass exchanger fo oparatus. gde of other courses (lit	eat transfer and them ative and quantitative rdge and to balance t ds) and to calculate t edge for the descripti or a specific applicati
Personal Competence Social Competence	 The students are capable to work on subject-specific challenges in tea other students. 	ims and to present the res	ults orally in a reasonat	ole manner to tutors a
Autonomy	 The students are able to find and evaluate necessary information from s They are able to prove their level of knowledge during the course assignments) and on this basis they can control their learning processe 	with accompanying proc	cedure continuously (cl	licker-system, exam-li
Workload in Hours	Independent Study Time 138, Study Time in Lecture 42			
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 Engi	neering: Compulsory		
Curricula				
	General Engineering Science (German program): Specialisation Energy and E			
	General Engineering Science (German program, 7 semester): Specialisation P		-	
	General Engineering Science (German program, 7 semester): Specialisation B			
	General Engineering Science (German program, 7 semester): Specialisation E	nergy and Enviromental E	ingineering: Compulsory	/
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Compulsory			
	General Engineering Science (English program): Specialisation Bioprocess Er		Compulsory	
	General Engineering Science (English program): Specialisation Energy and En		Jompulsory	
	Concerned Engineering Science (English and another Sciences) Out of the Party of Sciences			
	General Engineering Science (English program): Specialisation Process Engin		nulsory	
	General Engineering Science (English program, 7 semester): Specialisation Program, 7 semester)	rocess Engineering: Comp		
	General Engineering Science (English program, 7 semester): Specialisation Pr General Engineering Science (English program, 7 semester): Specialisation Bi	rocess Engineering: Comp ioprocess Engineering: Co	ompulsory	,
	General Engineering Science (English program, 7 semester): Specialisation Program, 7 semester)	rocess Engineering: Comp ioprocess Engineering: Co nergy and Enviromental Er	ompulsory	
	General Engineering Science (English program, 7 semester): Specialisation Pr General Engineering Science (English program, 7 semester): Specialisation Bi General Engineering Science (English program, 7 semester): Specialisation En	rocess Engineering: Comp ioprocess Engineering: Co nergy and Enviromental Er	ompulsory	



Course L0101: Heat and Mass Trans	sfer
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 Mass transfer one-way diffusion, equimolar countercurrent diffusion boundary layer theory, non-steady mass transfer Heat and mass transfer single particle/ fixed bed Mass transfer and chemical reactions
Literature	 H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer VDI-Wärmeatlas

Course L0102: Heat and Mass Transfer	
Тур	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	 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. 1. H.D. Baehr und K. Stephan: Wärme- und Stoffübertragung, Springer
	2. VDI-Wärmeatlas



Module M0546: Thermal Se	paration Processes			
Courses				
ītle		Тур	Hrs/wk	CP
hermal Separation Processes (L0118)		Lecture	3	3
Thermal Separation Processes (L0119)		Recitation Section (small)	2	1
Thermal Separation Processes (L0141) Separation Processes (L1159)		Recitation Section (large) Laboratory Course	1	1
	Draf Iring Caring out		I	I
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 follov	ving learning results		
Professional Competence				
Knowledge				
	 The students can distinguish and describe different typ 	es of separation processes such as distillatio	n, extraction, and ad	sorption
	The students develop an understanding for the course	e of concentration during a separation proce	ss, the estimation of	f the energy demand of
	process, the possibilities of energy saving, and the sele	ection of separation systems		
	 They have good knowledge of designing methods for s 	separation processes and devices		
Skills		and the second		
	Using the gained knowledge the students can select a	reasonable system boundary for a given sep	aration process and	can close the associate
	energy and material balances			
	 The students can use different graphical methods for the 	ne designing of a separation process and defi	ne the amount of the	oretical stages required
	 They can select and design a basic type of thermal s 	separation process for a given case based	on the advantages a	and disadvantages of the
	process			
	The students are capable to obtain independently the r	needed material properties from appropriate	sources (diagrams ar	nd tables)
	 They can calculate continuous and discontinuous proc 	cesses		
	The students are able to prove their theoretical knowle			
	 The students are able to discuss the theoretical backgr 		rk with the teachers i	n colloquium
				noonoquianii
	The students are capable of linking their gained knowledge v	with the content of other lectures and use it to	ogether for the solution	on of technical problem
	Other lectures such as thermodynamics, fluid mechanics and o	chemical engineering.		
Personal Competence				
Social Competence	• The students can work technical assignments in small	groups and present the combined results in the	ne tutorial	
	 The students are able to carry out practical lab work in 	n small groups and organize a functional div	sion of labor betwee	en them. They are able
	discuss their results and to document them scientificall			
	discuss their results and to document them scientifican	y in a report.		
Autonomy				
	 The students are capable to obtain the needed information 	ation from suitable sources by themselves and	d assess their quality	
	 The students can proof the state of their knowledge wit 	th exam resembling assignments and in this v	vay control their learr	ning 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): Specialisati			
Curricula	General Engineering Science (German program): Specialisati			
	General Engineering Science (German program): Specialisati	on Energy and Enviromental Engineering: Co	ompulsory	
	General Engineering Science (German program, 7 semester):	Specialisation Process Engineering: Compu	lsory	
	General Engineering Science (German program, 7 semester):	Specialisation Bioprocess Engineering: Com	pulsory	
	General Engineering Science (German program, 7 semester):	Specialisation Energy and Enviromental Eng	ineering: Compulso	ry
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification: Co	ompulsory		
	s, and in share in gride on gradine attention of			
	General Engineering Science (English program): Specialized	an Bioprocess Engineering, Compulsory		
	General Engineering Science (English program): Specialisatio			
	General Engineering Science (English program): Specialisation	on Energy and Enviromental Engineering: Co	mpulsory	
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio	on Energy and Enviromental Engineering: Co on Process Engineering: Compulsory		
	General Engineering Science (English program): Specialisation	on Energy and Enviromental Engineering: Co on Process Engineering: Compulsory		
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio	on Energy and Enviromental Engineering: Co on Process Engineering: Compulsory Specialisation Process Engineering: Compul	sory	
	General Engineering Science (English program): Specialisatio General Engineering Science (English program): Specialisatio General Engineering Science (English program, 7 semester):	on Energy and Enviromental Engineering: Co on Process Engineering: Compulsory Specialisation Process Engineering: Compul Specialisation Bioprocess Engineering: Com	sory pulsory	у



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. 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



Тур	Recitation Section (small)
Hrs/wk	
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Prof. Irina Smirnova
Language	DE
Cycle	WiSe
Content	
CONTON	 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. Steinko
	Darmstadt; Springer, New York; 1994. ISBN 3-7985-0944-1 ; ISBN 0-387-91477-3 .
	R. Goedecke (Hrsg.): Fluid-Verfahrenstechnik, Wiley-VCH Verlag, Weinheim, 2006.
	 Perry's Chemical Engineers" Handbook, R.H. Perry, D.W. Green, J.O. Maloney (Hrsg.), 6th ed., McGraw-Hill, New York 1984 Ullmann
	Enzyklopädie der Technischen Chemie



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



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
	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
	 Extraction: 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. Steinkoj 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			
	eaction Engineering			
Courses				
Title		Тур	Hrs/wk	CP
Chemical Reaction Engineering (Fundamentals) (L0204)		Lecture	2	2
Chemical Reaction Engineering (Fundame	ntals) (L0244)	Recitation Section (large)	2	2
Experimental Course Chemical Engineerin	g (Fundamentals) (L0221)	Laboratory Course	2	2
Module Responsible	Prof. Raimund Horn			
Admission Requirements	None			
Recommended Previous	Contents of the previous modules mathematics I-III, physical chemistry, technical thermodynamics I+II as well as computational methods for engineers.			
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ned the following learning results		
Professional Competence				
Knowledge	The students are able to explain basic concepts of chemical reaction engineering. They are able to point out differences between thermodynamical ar			
	kinetical processes. The students have a strong all	bility to outline parts of isothermal and non-isothermal ide	al reactors and to de	scribe their properties.
Skills	After successful completion of the module, students are able to:			
	- apply different computational methods to dimension isothermal and non-isothermal ideal reactors,			
	- determine and compute stable operation points f	for these reactors ,		
	- conduct experiments on a lab-scale pilot plants a	and document these according to scientific guidelines.		
Personal Competence				
Social Competence	After successful completition of the lab-course th	ne students have a strong ability to organize themselfes	s in small groups to	solve issues in chemic
	reaction engineering. The students can discuss th	eir subject related knowledge among each other and with	n their teachers.	
Autonomy	The students are able to obtain further information	on and assess their relevance autonomously. Students	can apply their know	vldege discretely to pla
	prepare and conduct experiments.			
Workload in Hours	Independent Study Time 96, Study Time in Lecture	e 84		
Credit points	6			
Examination	Written exam			
Examination duration and scale	120 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	7 semester): Specialisation Process Engineering: Compu	Ilsory	
	General Engineering Science (German program, 7	7 semester): Specialisation Bioprocess Engineering: Con	npulsory	
	Bioprocess Engineering: Core qualification: Comp			
	General Engineering Science (English program):	Specialisation Bioprocess Engineering: Compulsory		
	General Engineering Science (English program):	Specialisation Process Engineering: Compulsory		
		7 semester): Specialisation Process Engineering: Computer Specialisation	Isory	
		semester): Specialisation Bioprocess Engineering: Com		
	Process Engineering: Core qualification: Compuls			

Course L0204: Chemical Reaction Engineering (Fundamentals)		
Тур	Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Raimund Horn	
Language	DE	
Cycle	WiSe	
Content	Fundamentals of chemical reaction engineering, definitions, calculation of species concentrations (reactor, reaction mixture, reactants, products, inerts and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentration, mass- concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, conversion, selectivity, yield, concentration calculations in stationary and flowing multicomponent-mixtures)	
	Stoichiometry and stoichiometric calculations (simple reactions, complex reactions, key reactions, key species, matrix of stoichiometric coefficients, linear dependent and independent reactions, element-species-matrix, row reduced form of a matrix, rank of a matrix, Gauss Jordan elimination, relation between stoichiometry and kinetics, calculating the extent of reaction from mole number changes in complex reactions)	
	Thermodynamics (What is thermodynamics?, importance of thermodynamics in chemical reaction engineering, zeroth law of thermodynamics, temperature scales, temperature measurements in praxis, first law of thermodynamics, internal energy, enthalpy, calorimeter, heat of reaction, standard heat of formation, Hess law, heat capacity, Kirchhoff law, standard heat of reaction, pressure dependence of the heat of reaction, second law of thermodynamics, reversible and irreversible processes, entropy, Clausius inequality, free energy, Gibbs Energy, chemical potential, chemical equilibrium, activity, van't Hoff law, calculation of chemical equilibrium, principle of Le Chatelier and Braun, equilibrium calculations in multiple reaction systems, Lagrange Multipliers)	
	Chemical kinetics (reversible and irreversible reactions, homogeneous and heterogeneous reactions, elementary step, reaction mechanism, microkinetics, macrokinetics, formal kinetics, reaction rate, rate of change of species mole number, Arrhenius-equation, activation energy and pre- exponential factor for komplex reactions, reactions of 0., 1. and 2. order, analytical integration of rate laws, Damköhler-number, differential and integral method of kinetic analysis, laboratory reactors for kinetic measurements, half life, kinetics of complex reactions, parallel reactions, reversible reactions, sequence of reactions, irreversible reaction with pre-equilibrium, reduction of reaction mechanisms, quasi-stationarity principle of Bodenstein, rate limiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of complex kinetics)	
	Types of chemical Reaktors (chemical reactors in industry and laboratory, ideal vs. real reaktors, discontinuous, half continuous and continuous reactors,	



	single phase - biphasic- and multiphase reactors, batch-reactor, semi-batch reactor, CSTR, Plug Flow reactor, fixed bed reactor, adiabatic staged reactors, rotating furnaces, fluidized bed reactors, gas-liquid-reactors, multi-phase reactors)
	Isothermal ideal reactors (mole-balance of a chemical reactor, mole balance of a batch reactor, integration of the batch reactor mole balance for various kinetics, partial fraction decomposition, mole balance of the semi-batch reactor, mole balance of the plug flow reactor, analogy batch reactor - plug flow reactor, design of plug flow reactors for reactions with volume change and complex reactions, mole balance of a fixed bed reactor, design of a membrane reactor, mole balance of a continuously stirred tank reactor, comparison of CSTR and PFR with respect to conversion and selectivity, mole-balance of a cascade of tank reactors, numerical-interative calculation of a cascade of tank reactors, Newton-Raphson method, graphical analysis of a cascade of tank reactors)
	non-isothermal ideal reactors (energy balance of a reactor, adiabatic reactor, adiabatic temperature rise, staged reactor for adiabatic exothermic reactions limited by chemical equilibrium, design of an adiabatic plug flow reactor, Levenspiel-plots, heat transfer through a reactor wall, heat transfer by convection, heat conduction, heat transfer through a cylindrical wall, design of a plug flow reactor in parallel and counter flow, heat balance of the cooling fluid, CSTR with heat exchange, multiple stationary states, ignition-extinction behavior, stability of a CSTR, complex reactions in non-isothermal reactors, optimum temperature profile of a reactor)
Literature	lecture notes Raimund Horn
	skript Frerich Keil
	Books:
	M. Baerns, A. Behr, A. Brehm, J. Gmehling, H. Hofmann, U. Onken, A. Renken, Technische Chemie, Wiley-VCH
	G. Emig, E. Klemm, Technische Chemie, Springer
	A. Behr, D. W. Agar, J. Jörissen, Einführung in die Technische Chemie
	E. Müller-Erlwein, Chemische Reaktionstechnik 2012, 2. Auflage, Teubner Verlag
	J. Hagen, Chemiereaktoren: Auslegung und Simulation, 2004, Wiley-VCH
	H. S. Fogler, Elements of Chemical Reaction Engineering, Prentice Hall B
	H. S. Fogler, Essentials of Chemical Reaction Engineering, Prentice Hall
	O. Levenspiel, Chemical Reaction Engineering, John Wiley & Sons, 1998
	L. D. Schmidt, The Engineering of Chemical Reactions, Oxford Univ. Press, 2009
	J. B. Butt, Reaction Kinetics and Reactor Design, 2000, Marcel Dekker
	R. Aris, Elementary Chemical Reactor Analysis, Dover Pubn. Inc., 2000
	M. E. Davis, R. J. Davis, Fundamentals of Chemical Reaction Engineering, McGraw Hill
	G. F. Froment, K. B. Bischoff, J. De Wilde, Chemical Reactor Analysis and Design, John Wiley & Sons, 2010
	A. Jess, P. Wasserscheid, Chemical Technology An Integrated Textbook, WILEY-VCH



	Recitation Section (large)	
Hrs/wk		
CP Werklood in Hours	2 Independent Study Time 22, Study Time in Lecture 09	
Workload in Hours Lecturer	Independent Study Time 32, Study Time in Lecture 28	
Language	Prof. Raimund Horn, Dr. Oliver Korup DE	
Cycle		
Content		
	and solvents, reaction volume, Reaktor volume, chemical reaction, mass, moles, mole fraction, volume, density, molar concentrati concentration, molality, partial pressure, hydrodynamic residence time, space time, extent of reaction, reactor throughput, reactor load, of selectivity, yield, concentration calculations in stationary and flowing multicomponent-mixtures) Stoichiometry and stoichiometric calculations (simple reactions, complex reactions, key species, matrix of stoichiometric coeffici	
	dependent and independent reactions, element-species-matrix, row reduced form of a matrix, rank of a matrix, Gauss Jordan elimination, rela between stoichiometry and kinetics, calculating the extent of reaction from mole number changes in complex reactions)	
	Thermodynamics (What is thermodynamics?, importance of thermodynamics in chemical reaction engineering, zeroth law of thermodynamic temperature scales, temperature measurements in praxis, first law of thermodynamics, internal energy, enthalpy, calorimeter, heat of reaction, stand heat of formation, Hess law, heat capacity, Kirchhoff law, standard heat of reaction, pressure dependence of the heat of reaction, second law thermodynamics, reversible and irreversible processes, entropy, Clausius inequality, free energy, Gibbs Energy, chemical potential, chem equilibrium, activity, van't Hoff law, calculation of chemical equilibrium, principle of Le Chatelier and Braun, equilibrium calculations in multiple reactions, systems, Lagrange Multipliers)	
	Chemical kinetics (reversible and irreversible reactions, homogeneous and heterogeneous reactions, elementary step, reaction mechan microkinetics, macrokinetics, formal kinetics, reaction rate, rate of change of species mole number, Arrhenius-equation, activation energy and exponential factor for komplex reactions, reactions of 0., 1. and 2. order, analytical integration of rate laws, Damköhler-number, differential and intermethod of kinetic analysis, laboratory reactors for kinetic measurements, half life, kinetics of complex reactions, parallel reactions, reversible reacti sequence of reactions, irreversible reaction with pre-equilibrium, reduction of reaction mechanisms, quasi-stationarity principle of Bodenstein, limiting step, Michaelis-Menten kinetics, analytical integration of first order differential equations - integrating factor, numerical integration of com kinetics)	
	Types of chemical Reaktors (chemical reactors in industry and laboratory, ideal vs. real reaktors, discontinuous, half continuous and continuous reac single phase - biphasic- and multiphase reactors, batch-reactor, semi-batch reactor, CSTR, Plug Flow reactor, fixed bed reactor, adiabatic sta reactors, rotating furnaces, fluidized bed reactors, gas-liquid-reactors, multi-phase reactors)	
	Isothermal ideal reactors (mole-balance of a chemical reactor, mole balance of a batch reactor, integration of the batch reactor mole balance for var kinetics, partial fraction decomposition, mole balance of the semi-batch reactor, mole balance of the plug flow reactor, analogy batch reactor - plug reactor, design of plug flow reactors for reactions with volume change and complex reactions, mole balance of a fixed bed reactor, design membrane reactor, mole balance of a continuously stirred tank reactor, comparison of CSTR and PFR with respect to conversion and selectivity, m balance of a cascade of tank reactors, numerical-interative calculation of a cascade of tank reactors, Newton-Raphson method, graphical analysis cascade of tank reactors)	
	non-isothermal ideal reactors (energy balance of a reactor, adiabatic reactor, adiabatic temperature rise, staged reactor for adiabatic exothe reactions limited by chemical equilibrium, design of an adiabatic plug flow reactor, Levenspiel-plots, heat transfer through a reactor wall, heat transfer convection, heat conduction, heat transfer through a cylindrical wall, design of a plug flow reactor in parallel and counter flow, heat balance of cooling fluid, CSTR with heat exchange, multiple stationary states, ignition-extinction behavior, stability of a CSTR, complex reactions in non-isother reactors, optimum temperature profile of a reactor)	
Literature	lecture notes Raimund Horn	
	skript Frerich Keil	
	Books:	
	M. Baerns, A. Behr, A. Brehm, J. Gmehling, H. Hofmann, U. Onken, A. Renken, Technische Chemie, Wiley-VCH	
	G. Emig, E. Klemm, Technische Chemie, Springer	
	A. Behr, D. W. Agar, J. Jörissen, Einführung in die Technische Chemie	
	E. Müller-Erlwein, Chemische Reaktionstechnik 2012, 2. Auflage, Teubner Verlag	
	J. Hagen, Chemiereaktoren: Auslegung und Simulation, 2004, Wiley-VCH	
	H. S. Fogler, Elements of Chemical Reaction Engineering, Prentice Hall B	
	H. S. Fogler, Essentials of Chemical Reaction Engineering, Prentice Hall	
	O. Levenspiel, Chemical Reaction Engineering, John Wiley & Sons, 1998	
	L. D. Schmidt, The Engineering of Chemical Reactions, Oxford Univ. Press, 2009	
	J. B. Butt, Reaction Kinetics and Reactor Design, 2000, Marcel Dekker	
	R. Aris, Elementary Chemical Reactor Analysis, Dover Pubn. Inc., 2000	
	M. E. Davis, R. J. Davis, Fundamentals of Chemical Reaction Engineering, McGraw Hill	
	G. F. Froment, K. B. Bischoff, J. De Wilde, Chemical Reactor Analysis and Design, John Wiley & Sons, 2010	
	A. Jess, P. Wasserscheid, Chemical Technology An Integrated Textbook, WILEY-VCH	



Тур	Laboratory Course		
Hrs/wk			
CP			
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
	Prof. Raimund Horn, Dr. Achim Bartsch		
Language	DE/EN		
Cycle			
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 a 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.), that they can improve their competence in this field over the course of the practical course.		
Literature	Levenspiel, O.: Chemical reaction engineering; John Wiley & Sons, New York, 3. Ed., 1999 VTM 309(LB)		
	Praktikumsskript		
	Skript Chemische Verfahrenstechnik 1 (F.Keil)		



Module M1275: Environme	ntal Technology			
Courses				
Title		Тур	Hrs/wk	CP
Practical Exercise Environmental Technol	logy (L1387)	Laboratory Course	1	1
Environmental Technologie (L0326)		Lecture	2	2
Module Responsible	Dr. Joachim Gerth			
Admission Requirements	None			
Recommended Previous	Fundamentals of inorganic/organic chemistry and biolog	Ϋ́		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge	With the completion of this modul the students obtain	profound knowledge of environmental technolo	ogy. They are able to d	escribe the behaviour (
	chemicals in the environment. Students can give an o	overview of scientific disciplines involved. They	can explain terms and	allocate them to relate
	methods.			
			bland Theorem able to	determine a second contra
Skills	Students are able to propose appropriate management	•		-
	parameters and to assess the potential of pollutants	•		
	Environmental Technology contributes to sustainable de	evelopment, and they can present and delend th	ese opinons in ironi oi a	no against the group.
Personal Competence				
Social Competence				
	approaches to the task as a group as well as to discuss	their theoretical or practical implementation.		
A				
Autonomy	Students can independently exploit sources about of the	subject, acquire the particular knowledge and t	ramer it to new problems	5.
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Examination	Written exam			
Examination duration and scale	1 hour written exam			
	General Engineering Science (German program): Speci			
Assignment for the Following		alisation Energy and Enviromental Engineering	: Compulsory	
Assignment for the Following Curricula	General Engineering Science (German program): Speci			
	General Engineering Science (German program): Spec General Engineering Science (German program, 7 sem	alisation Process Engineering: Elective Compul	sory	у
		alisation Process Engineering: Elective Compul ester): Specialisation Energy and Enviromental I	sory Engineering: Compulsor	у
	General Engineering Science (German program, 7 sem	alisation Process Engineering: Elective Compul ester): Specialisation Energy and Enviromental I ester): Specialisation Process Engineering: Elec	sory Engineering: Compulsor tive Compulsory	у
	General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem	alisation Process Engineering: Elective Comput ester): Specialisation Energy and Enviromental I ester): Specialisation Process Engineering: Elec ester): Specialisation Bioprocess Engineering: E	sory Engineering: Compulsor tive Compulsory	у
	General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem	alisation Process Engineering: Elective Comput ester): Specialisation Energy and Enviromental I ester): Specialisation Process Engineering: Elec ester): Specialisation Bioprocess Engineering: E mpulsory	sory Engineering: Compulsor tive Compulsory	у
	General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Bioprocess Engineering: Core qualification: Elective Co	alisation Process Engineering: Elective Comput ester): Specialisation Energy and Enviromental I ester): Specialisation Process Engineering: Elec ester): Specialisation Bioprocess Engineering: E mpulsory ion: Compulsory	sory Engineering: Compulsor tive Compulsory Elective Compulsory	у
	General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Bioprocess Engineering: Core qualification: Elective Co Energy and Environmental Engineering: Core qualificat	alisation Process Engineering: Elective Comput ester): Specialisation Energy and Enviromental I ester): Specialisation Process Engineering: Elec ester): Specialisation Bioprocess Engineering: E mpulsory ion: Compulsory alisation Energy and Enviromental Engineering:	sory Engineering: Compulsor tive Compulsory Elective Compulsory Compulsory	У
	General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Bioprocess Engineering: Core qualification: Elective Co Energy and Environmental Engineering: Core qualificat General Engineering Science (English program): Specie	alisation Process Engineering: Elective Comput ester): Specialisation Energy and Enviromental I ester): Specialisation Process Engineering: Elec ester): Specialisation Bioprocess Engineering: E mpulsory ion: Compulsory alisation Energy and Enviromental Engineering: alisation Process Engineering: Elective Compute	sory Engineering: Compulsor tive Compulsory Elective Compulsory Compulsory sory	-
	General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Bioprocess Engineering: Core qualification: Elective Co Energy and Environmental Engineering: Core qualificat General Engineering Science (English program): Speci General Engineering Science (English program): Speci	alisation Process Engineering: Elective Comput ester): Specialisation Energy and Enviromental I ester): Specialisation Process Engineering: Elec ester): Specialisation Bioprocess Engineering: E mpulsory ion: Compulsory alisation Energy and Enviromental Engineering: alisation Process Engineering: Elective Computs ester): Specialisation Energy and Enviromental E	sory Engineering: Compulsor tive Compulsory Elective Compulsory Compulsory sory Engineering: Compulsor	-
	General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem General Engineering Science (German program, 7 sem Bioprocess Engineering: Core qualification: Elective Co Energy and Environmental Engineering: Core qualificat General Engineering Science (English program): Speci General Engineering Science (English program): Speci General Engineering Science (English program): Speci	alisation Process Engineering: Elective Comput ester): Specialisation Energy and Enviromental I ester): Specialisation Process Engineering: Elec ester): Specialisation Bioprocess Engineering: E mpulsory ion: Compulsory alisation Energy and Enviromental Engineering: alisation Process Engineering: Elective Compuls ester): Specialisation Energy and Enviromental E ester): Specialisation Process Engineering: Elect	sory Engineering: Compulsor tive Compulsory Elective Compulsory Compulsory sory Engineering: Compulsor tive Compulsory	-

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



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



Module M0956: Measureme	ent Technology for Mechanical and Proces	s Engineers		
Courses				
Title		Тур	Hrs/wk	CP
Practical Course: Measurement and Cont	rol Systems (L1119)	Laboratory Course	2	2
Measurement Technology for Mechanical		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 engir	neering		
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fo	llowing learning results		
Professional Competence				
Knowledge	Students are able to name the most important fundmental	s of the Measurement Technology (Quantities	and Units, Uncertaint	y, Calibration, Static ar
-	Dynamic Properties of Sensors and Systems).			
	They can outline the most important measuring methods for	or different kinds of quantities to be maesured (Electrical Quantities,	Temperature, mechanic
	quantities, Flow, Time, Frequency).			
	They can describe important methods of chemical Analysis	s (Gas Sensors, Spectroscopy, Gas Chromatogr	aphy)	
Skills	Students can select suitable measuring methods to given p	problems and can use refering measurement de	vices in practice.	
	The students are able to orally explain issues in the subje	ect area of measurement technology and solution	on approaches as we	II as place the issues in
	the right context and application area.			
Personal Competence				
Social Competence	Students can arrive at work results in groups and documer	nt them in a common report.		
		·		
Autonomy	Students are able to familiarize themselves with new meas	surement 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): Speciali		Compulsory	
Curricula	General Engineering Science (German program): Speciali			
	General Engineering Science (German program): Speciali			
	General Engineering Science (German program): Speciali	sation Process Engineering: Compulsory		
	General Engineering Science (German program, 7 semest			ry
	General Engineering Science (German program, 7 semest			
	General Engineering Science (German program, 7 semes			
	General Engineering Science (German program, 7 semest		ulsory	
	Energy and Environmental Engineering: Core qualification			
	General Engineering Science (English program): Specialis		ompulsory	
	General Engineering Science (English program): Specialis			
	General Engineering Science (English program): Specialis			
	General Engineering Science (English program): Specialis	0 0 1 9		
	General Engineering Science (English program, 7 semeste			У
	General Engineering Science (English program, 7 semeste			
	General Engineering Science (English program, 7 semeste	, 1 0 0	1	
	General Engineering Science (English program, 7 semeste	er): Specialisation Process Engineering: Compu	llsory	
	Mechanical Engineering: Core qualification: Compulsory			
	Mechatronics: Core qualification: Compulsory			
	Process Engineering: Core qualification: Compulsory			



	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Wolfgang Schröder
Language	DE
Cycle	WiSe/SoSe
Content	Experiment 1: Emission and immission measurement of gaseous pollutants: different technologies to determine different gaseous pollutants i 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. Th 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 Michelso 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., Wissenschaftlich Verlagsgesellschaft, Stuttgart, 1974 Birkle, M.: Meßtechnik für den Immissionsschutz, Messen der gas- und partikelförmigen Luftverunreinigungen. R. Oldenburg Verlag, Müncher 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



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

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



Module M0539: Process an	d Plant Engineering I			
Courses				
Title		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 lea	rning results		
Professional Competence				
Knowledge	students can:			
	classify and formulate blobal balance equations of chemical processe	S		
	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 o	f product streams		
	- estimation of component streams of chemical plants using linear con	ponent balance models		
	- solution of data reconcilliation tasks			
	- conduction of process synthesis			
	- economic evaluation of processes and the estimation of production of	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 Proc	ess Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisation Biop	rocess Engineering: Compulsory		
	General Engineering Science (German program, 7 semester): Specia			
	General Engineering Science (German program, 7 semester): Specia			
	General Engineering Science (German program, 7 semester): Specia	lisation Energy and Enviromental Eng	gineering: Elective Co	mpulsory
	Bioprocess Engineering: Core qualification: Compulsory	E i i o i		
	General Engineering Science (English program): Specialisation Biop			
	General Engineering Science (English program): Specialisation Proce			
	General Engineering Science (English program, 7 semester): Special	• • •	•	
	General Engineering Science (English program, 7 semester): Special	, , ,		nulcory
	General Engineering Science (English program, 7 semester): Special Process Engineering: Core qualification: Compulsory	isation Energy and Environmental Eng	meening. Elective Con	npuisory
	r rocess Engineering. Oure quamication. Compulsory			

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

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



	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
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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 Tee	chnology and Solids Process Engineering			
Courses				
Title		Тур	Hrs/wk	CP
Particle Technology I (L0434)		Lecture	2	3
Particle Technology I (L0435)		Recitation Section (small)	1	1
Particle Technology I (L0440)		Laboratory Course	2	2
Module Responsible	Prof. Stefan Heinrich			
Admission Requirements	None			
Recommended Previous	keine			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following part successfully.	owing 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 dis 			
	· · · · · · · · · · · · · · · · · · ·	F F		
01.11	Ob deale an able to			
Skills	Students are able to			
	 choose and design apparatuses and processes for set 	olids processing according to the desired solid	Is properties of the p	oduct
	asses solids with respect to their behavior in solids processing steps			
	 document their work scientifically. 			
Personal Competence				
Social Competence	The students are able to discuss scientific topics orally with	other students or scientific personal and to dev	velop solutions for te	chnical-scientific issues
	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): Specialisa	tion Process Engineering: Compulsory		
Curricula	General Engineering Science (German program): Specialisa	tion Bioprocess Engineering: Compulsory		
	General Engineering Science (German program): Specialisa	tion Energy and Enviromental Engineering: C	ompulsory	
	General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compu	ulsory	
	General Engineering Science (German program, 7 semester): Specialisation Bioprocess Engineering: Cor	npulsory	
	General Engineering Science (German program, 7 semester): Specialisation Energy and Enviromental En	gineering: Compulso	ry
	Bioprocess Engineering: Core qualification: Compulsory			
	Energy and Environmental Engineering: Core qualification:	Compulsory		
	General Engineering Science (English program): Specialisa	tion Bioprocess Engineering: Compulsory		
	General Engineering Science (English program): Specialisa	tion Energy and Enviromental Engineering: Co	ompulsory	
	General Engineering Science (English program): Specialisa	tion Process Engineering: Compulsory		
	General Engineering Science (English program, 7 semester	: Specialisation Process Engineering: Compu	lsory	
	General Engineering Science (English program, 7 semester	: Specialisation Bioprocess Engineering: Con	npulsory	
	General Engineering Science (English program, 7 semester	: Specialisation Energy and Enviromental Eng	gineering: Compulso	у
	Process Engineering: Core qualification: Compulsory			



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

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

Course L0440: Particle Technology	1
Тур	Laboratory Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Stefan Heinrich
Language	DE
Cycle	SoSe
Content	 Sieving Bulk properties Size reduction Mixing Gas cyclone Blaine-test, filtration Sedimentation
Literature	Schubert, H.; Heidenreich, E.; Liepe, F.; Neeße, T.: Mechanische Verfahrenstechnik. Deutscher Verlag für die Grundstoffindustrie, Leipzig, 1990. Stieß, M.: Mechanische Verfahrenstechnik I und II. Springer Verlag, Berlin, 1992.



Courses				
		_		
Fitle ntroduction to Management (L0880)		Typ Lecture	Hrs/wk 3	CP 3
Project Entrepreneurship (L0882)		Problem-based Learning	2	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fol	lowing learning results		
Professional Competence				
Knowledge	After taking this module, students know the important basic Marketing and Innovation, and also to Investment and Cont • explain the differences between Economics and Ma	rolling. In particular they are able to		
	 explain the uniformed between Excitonics and matrix field of Management explain the most important aspects of and goals in N describe and explain basic business functions as p 	lanagement and name the most important asp	ects of entreprneurial p	rojects
	 ressource management, information management, i explain the relevance of planning and decision ma some basic methods from mathematical Finance 	aking in Business, esp. in situations under mu	ultiple objectives and	uncertainty, and expla
Skills	 state basics from accounting and costing and select Students are able to analyse business units with res 		ctives, strategies etc.) and to carry out
	Entrepreneurship project in a team. In particular, they are al			
	 analyse Management goals and structure them approved analyse organisational and staff structures of compared to the structures of compared to the structure of the			
	 apply methods for decision making under multiple o 			
	 analyse production and procurement systems and B 			
	analyse and apply basic methods of marketing			
	select and apply basic methods from mathematical f	inance to predefined problems		
	apply basic methods from accounting, costing and c	ontrolling to predefined problems		
Personal Competence				
Social Competence	Students are able to			
	 work successfully in a team of students 			
	 to apply their knowledge from the lecture to an entre 	preneurship project and write a coherent repor	t on the proiect	
	 to communicate appropriately and 	ранана раската стала		
	• to cooperate respectfully with their fellow students.			
A. (Objekt and a state of the late			
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			
	General Engineering Science (German program): Specialis	ation Electrical Engineering: Compulsory		
Assignment for the Following	General Engineering Science (German program): Specialis			
Assignment for the Following Curricula	General Engineering Science (German program): Specialis	ation Process Engineering: Compulsory		
• •	deneral Engineering belence (dennan program). Opeoland			
• •	General Engineering Science (German program): Specialis	ation Bioprocess Engineering: Compulsory		
• •			ompulsory	
• •	General Engineering Science (German program): Specialis	ation Energy and Enviromental Engineering: C		
• •	General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis General Engineering Science (German program): Specialis	ation Energy and Enviromental Engineering: C ation Civil- and Enviromental Engeneering: Co ation Mechanical Engineering: Compulsory		
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• •	General Engineering Science (German program): Specialis General Engineering Science (German program, 7 semester	ation Energy and Enviromental Engineering: C ation Civil- and Enviromental Engeneering: Co ation Mechanical Engineering: Compulsory ation Biomedical Engineering: Compulsory ation Naval Architecture: Compulsory ar): Specialisation Electrical Engineering: Comp	ompulsory	
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• •	General Engineering Science (German program): Specialis General Engineering Science (German program, 7 semeste General Engineering Science (German program, 7 semeste	ation Energy and Enviromental Engineering: C ation Civil- and Enviromental Engeneering: C ation Mechanical Engineering: Compulsory ation Biomedical Engineering: Compulsory ation Naval Architecture: Compulsory ation Naval Architecture: Compulsory ation Naval Architecture: Compulsory ation Specialisation Electrical Engineering: Comp ary: Specialisation Process Engineering: Compu- ary: Specialisation Naval Architecture: Compulsory ary: Specialisation Naval Architecture: Compulsory ary: Specialisation Computer Science: Compulsory ary: Specialisation Bioprocess Engineering: Com- ary: Specialisation Civil Engineering: Compulso ary: Specialisation Energy and Enviromental En- ary: Specialisation Mechanical Engineering, For ary: Specialisation Mechanical Engineering, For ary: Specialisation Mechanical Engineering, For ary: Specialisation Mechanical Engineering, For ary: Specialisation Mechanical Engineering, For	pulsory ulsory mpulsory ory ory mpulsory ry gineering: Compulsor cus Mechatronics: Cor cus Biomechanics: Co cus Aircraft Systems E	npulsory npulsory ngineering: Compulso
	General Engineering Science (German program): Specialis General Engineering Science (German program, 7 semeste General Engineering Science (German program, 7 semeste	ation Energy and Enviromental Engineering: C ation Civil- and Enviromental Engeneering: C ation Mechanical Engineering: Compulsory ation Biomedical Engineering: Compulsory ation Naval Architecture: Compulsory ation Specialisation Biomedical Engineering: Comp ary: Specialisation Naval Architecture: Compulsory ation: Specialisation Computer Science: Compulsory ary: Specialisation Bioprocess Engineering: Compulsory ation: Specialisation Energy and Enviromental En- ary: Specialisation Mechanical Engineering, For ary: Specialisation Mechanical Engineering, For astery: Specialisation Mechanical Engineering	pulsory pulsory mpulsory ory ory mpulsory ry gineering: Compulsor cus Mechatronics: Cor cus Biomechanics: Co cus Aircraft Systems Ei g, Focus Materials in	npulsory mpulsory ngineering: Compulso Engineering Scienc



Com	apulsory
Gen	eral Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Com	npulsory
Gen	eral Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Civil	- and Environmental Engineering: Core qualification: Compulsory
Biop	rocess Engineering: Core qualification: Compulsory
Com	nputer Science: Core qualification: Compulsory
Elec	trical Engineering: Core qualification: Compulsory
Ene	rgy and Environmental Engineering: Core qualification: Compulsory
Gen	eral Engineering Science (English program): Specialisation Civil- and Enviromental Engeneering: Compulsory
Gen	eral Engineering Science (English program): Specialisation Bioprocess Engineering: Compulsory
Gen	eral Engineering Science (English program): Specialisation Electrical Engineering: Compulsory
Gen	eral Engineering Science (English program): Specialisation Energy and Enviromental Engineering: Compulsory
Gen	eral Engineering Science (English program): Specialisation Computer Science: Compulsory
Gen	eral Engineering Science (English program): Specialisation Mechanical Engineering: Compulsory
Gen	eral Engineering Science (English program): Specialisation Biomedical Engineering: Compulsory
Gen	eral Engineering Science (English program): Specialisation Naval Architecture: Compulsory
Gen	eral Engineering Science (English program): Specialisation Process Engineering: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Energy and Enviromental Engineering: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences:
Com	npulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering:
Com	ipulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production:
Com	npulsory
Gen	eral Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory
Com	aputational Science and Engineering: Core qualification: Compulsory
Logi	stics and Mobility: Core qualification: Compulsory
Mec	hanical Engineering: Core qualification: Compulsory
Mec	hatronics: Core qualification: Compulsory
Nava	al Architecture: Core qualification: Compulsory
Tech	nomathematics: Core qualification: Compulsory
Proc	ess 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. 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 Manageme
	Marketing and Sales
	Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management
	 Definitions as information, information systems, aspects of data security and strategic information systems
	Definition and Relevance of innovations, e.g. innovation opporunities, risks etc.
	Relevance of marketing, B2B vs. B2C-Marketing
	 different techniques from the field of marketing (e.g. scenario technique), pricing strategies
	important organizational structures
	basics of human ressource management
	 Introduction to Business Planning and the steps of a planning process
	Decision Analysis: Elements of decision problems and methods for solving decision problems
	Selected Planning Tasks, e.g. Investment and Financial Decisions
	Introduction to Accounting: Accounting, Balance-Sheets, Costing
	Relevance of Controlling and selected Controlling methods
	Important aspects of Entrepreneurship projects
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.

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Thesis

lodule M-001: Bachelor Thesis Durses Typ Hrs/wk CP Module Responsible Professoren der TUHH Admission Requirements • According to General Regulations §24 (1): At least 126 ECTS credit points have to be achieved in study programme. The examinations board decides on exceptions. Recommended Previous Knowledge After taking part successfully, students have reached the following learning results Professional Completence Knowledge • The students can select, outline and, if need be, critically discuss the most important scientific fundamentals of their course o theories, and methods). • On the basis of their fundamental knowledge of their subject the students are capable in relation to a specific issue of opr establishing links with extended specialized expertise. • The students can make targeted use of the basic knowledge of their subject that they have acquired in their studies to solve s problems. • With the aid of the methods they have learnt during their studies the students can analyze problems, make decisions on technic develop solutions. • The students can take up a critical position on the findings of their own research work from a specialized perspective.	bening up and
Ite Typ Hrs.wk CP Module Responsible Professoren der TUHH Admission Requirements According to General Regulations §24 (1): At least 126 ECTS credit points have to be achieved in study programme. The examinations board decides on exceptions. Recommended Previous Knowledge 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 o theories, and methods). On the basis of their fundamental knowledge of their subject the students are capable in relation to a specific issue of opriestabilishing links with extended specialized expertise. The students can make targeted use of the basic knowledge of 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 s problems. With the aid of the methods they have learnt during their studies the students can analyze problems, make decisions on technic develop solutions. The students can take up a critical position on the findings of their own research work from a specialized perspective. 	eening up and subject-related
Module Responsible Professoren der TUHH Admission Requirements 	ening up and subject-related
Module Responsible Professoren der TUHH Admission Requirements 	eening up and
Admission Requirements According to General Regulations §24 (1):	eening up and
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 o theories, and methods). • On the basis of their fundamental knowledge of their subject the students are capable in relation to a specific issue of ope establishing links with extended specialized expertise. • The students can make targeted use of the basic knowledge of their subject that they have acquired in their studies to solve s problems. • With the aid of the methods they have learnt during their studies the students can analyze problems, make decisions on technici develop solutions. • The students can take up a critical position on the findings of their own research work from a specialized perspective.	bening up and
Recommended Previous After taking part successfully, students have reached the following learning results Professional Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge Knowledge • The students can select, outline and, if need be, critically discuss the most important scientific fundamentals of their course of theories, and methods). • On the basis of their fundamental knowledge of their subject the students are capable in relation to a specific issue of operestablishing 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 s problems. • With the aid of the methods they have learnt during their studies the students can analyze problems, make decisions on technica develop solutions. • The students can take up a critical position on the findings of their own research work from a specialized perspective.	eening up and
Knowledge After taking part successfully, students have reached the following learning results Professional Competence Knowledge Knowledge • The students can select, outline and, if need be, critically discuss the most important scientific fundamentals of their course of theories, and methods). On the basis of their fundamental knowledge of their subject the students are capable in relation to a specific issue of operestabilishing links with extended specialized expertise. Skills • The students can make targeted use of the basic knowledge of their subject that they have acquired in their studies to solve s problems. With the aid of the methods they have learnt during their studies the students can analyze problems, make decisions on technical develop solutions. • The students can take up a critical position on the findings of their own research work from a specialized perspective.	eening up and
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• 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 struction of the students of the	ctured way.
The students can deal with issues in an expert discussion and answer them in a manner that is appropriate to the addressees. In	doing so they
can uphold their own assessments and viewpoints convincingly.	
 Autonomy The students are capable of structuring an extensive work process in terms of time and of dealing with an issue within a specified tin 	me frame.
 The students are able to identify, open up, and connect knowledge and material necessary for working on a scientific problem. 	
The students can apply the essential techniques of scientific work to research of their own.	
Workload in Hours Independent Study Time 360, Study Time in Lecture 0	
Credit points 12	
Examination according to Subject Specific Regulations	
Examination duration and scale laut FSPO	
Assignment for the Following General Engineering Science (German program): Thesis: Compulsory	
Curricula General Engineering Science (German program, 7 semester): Thesis: Compulsory	
Civil- and Environmental Engineering: Thesis: Compulsory	
Bioprocess Engineering: Thesis: Compulsory	
Computer Science: Thesis: Compulsory	
Electrical Engineering: Thesis: Compulsory	
Energy and Environmental Engineering: Thesis: Compulsory	
General Engineering Science (English program): Thesis: Compulsory	
General Engineering Science (English program, 7 semester): Thesis: Compulsory	
Computational Science and Engineering: Thesis: Compulsory	
Logistics and Mobility: Thesis: Compulsory Mechanical Engineering: Thesis: Compulsory	
Mechatronics: Thesis: Compulsory	
Naval Architecture: Thesis: Compulsory	
Technomathematics: Thesis: Compulsory	
Process Engineering: Thesis: Compulsory	