Karlsruhe Institute of Technology

Module Handbook
Civil Engineering ER/SPO 2013 (B.Sc.)

Summer Term 2016
Short version
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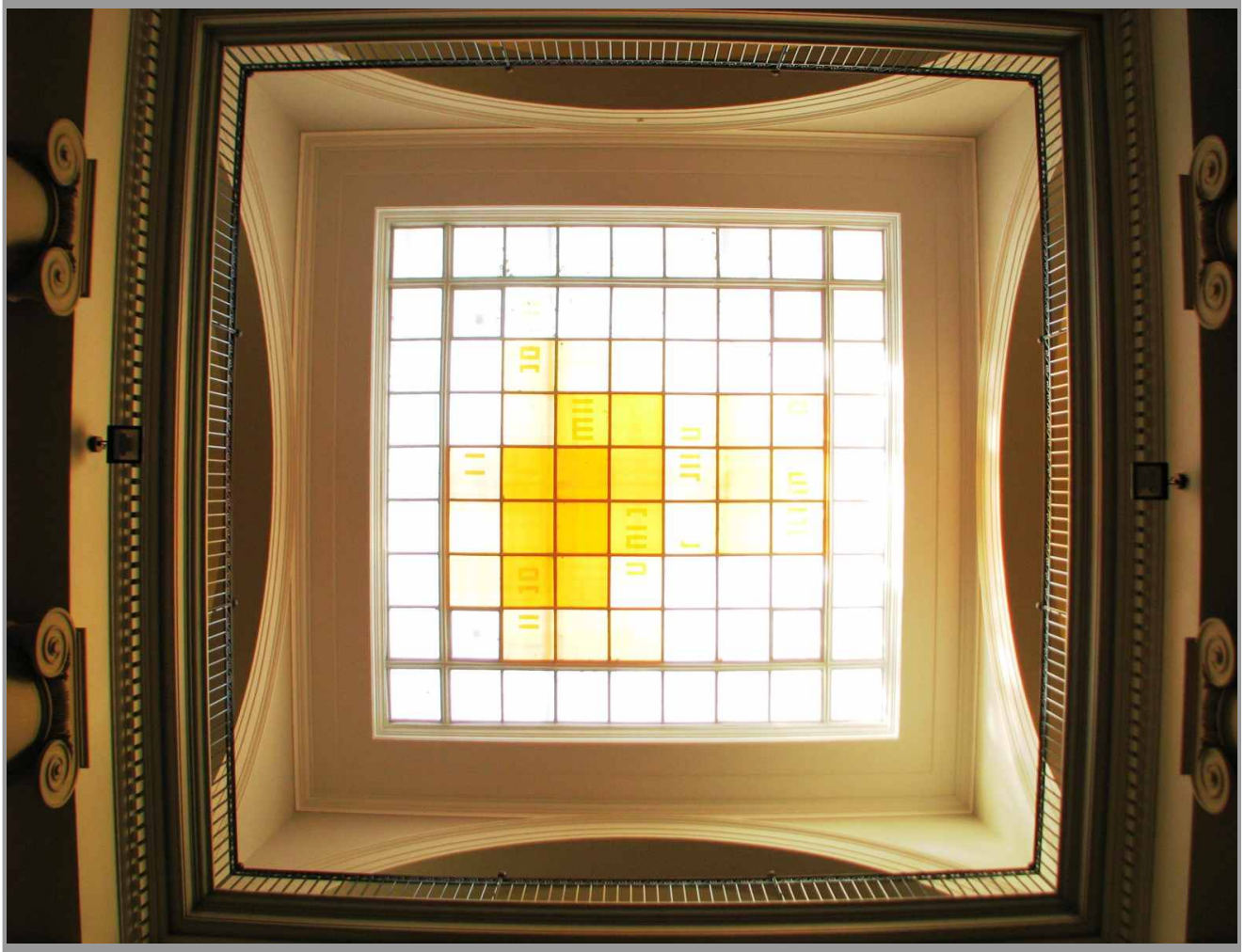
Department of Civil Engineering, Geo- and Environmental Sciences



KIT - University of the State of Baden-Wuerttemberg and
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Preface

The module handbook is the document in which important additional information about the studies is described. The general rules from the examination regulation and its several statutes for amendment and the structure of the programme are specified by the curriculum (chap. 1). Also, substantial issues of the course of studies (chap. 2) and changes (chap. 3) are described in detail. The main function of the Module Handbook is the compilation of the module descriptions (chap. 4).
In addition to the module handbook information about the execution of the single courses is collected within the course catalogue (on-line). Information about the examinations is provided by the self-service function for students. This information is also announced by postings and webpages of the institutes.

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1 Curriculum

Objectives of the Bachelor Study

The graduates of the bachelor degree programme are prepared for an employment in the entire range of the typical occupational fields and acquired scientific qualifications for entering a master degree programme in Civil Engineering or a related subject at the same time. They possess knowledge and master methods from the entire range of Civil Engineering and are therefore well prepared for every shaping of the occupational profile.
A civil engineer designs, plans, calculates, constructs, manages and maintains all kinds of buildings required by our society. This includes buildings of all types (for housing, business, administration and industry), transport routes (roads, bridges, tunnels, airports, railway systems, waterways), hydraulic structures (locks, dikes, dams etc.), any kind of power plants, facilities for the protection of the environment (water supply and drainage systems, waste water treatment plants, waste incineration plant), buildings for civil protection and much more. This very wide range of their professional activities is embraced by the job title Civil Engineer.
The graduates of the bachelor degree Civil Engineering have learned how to extend and deepen quickly their basic knowledge gained by theoretical studies and practical exercises, their competences in methods as well as their additional skills in related natural and engineering sciences by focused and efficient investigations and to apply these adapted to the demands.
They are able to introduce themselves to technical problems almost independently and to develop a solution under consideration of economic and societal aspects. They are also able to think holistically as well as to harmonize social, ecological and economic aspects. Their strength is their technical know-how, but also their team and communication skills are trained during the study.

Structure of the Bachelor Study

Generally, the programme is organized into **subjects**, **modules** and **courses**. Every subject (e.g. mathematics or mechanics) is split into modules. Every module consists of one or more interrelated courses and is completed by one or more examinations. The extent of every module is indicated by credit points, which will be credited after the successful completion of the module.
The programme covers 180 credit points (CP) and is divided into **Basic Studies** (semester 1-3) and **Basic Subject Studies** (consolidation studies, semester 4-6), see overview next page. The Basic Studies as well as the Basic Subject Studies are subdivided into a **Compulsory Part** and a **Compulsory Elective Part** to which the modules of the programme are assigned. The descriptions of all modules are included within this module handbook.

Basic Studies

The **Basic Studies** comprise 92 CP, 82 CP thereof in the Compulsory Part and 10 CP in the Compulsory Elective Part. The **Compulsory Part** includes the subjects Mechanics (28 CP, 4 modules), Mathematics (25 CP, 4 modules), Building Materials (12 CP, 2 modules), Structural Design (9 CP, 2 modules) as well as the modules Planning Methodology, Project Management, Geology in Civil Engineering and Introduction to Computer Programming I (2 CP each). The **Orientation Examinations** have to be taken in the courses Statics of Rigid Bodies (subject Mechanics), Theory of Building Materials (subject Building Materials) and Building Physics (subject Structural Design) by the end of the 2rd subject-related semester and have to be passed by the end of the 3rd subject-related semester.
The **Compulsory Elective Part** includes the module **Key Competences** (6 CP, compulsory) as well as 5 additional technical modules (2 CP each, compulsory elective). For the module **Key Competences**, courses amounting to a total of 6 CP have to be chosen from the respective course catalogues on key competences offered by the House of Competence (HoC) or the Centre for Cultural and General Studies (ZAK). The selection of 2 of the 5 additional technical modules (4 CP in total) completes the Compulsory Elective Part.

Basic Subject Studies

The **Basic Subject Studies** comprise 88 CP, 80 CP thereof in the Compulsory Part and 8 CP in the Compulsory Elective Part. The **Compulsory Part** includes the subjects Structural Analysis (10 LP), Structural Engineering (15 LP), Water and Environment (12 LP), Mobility and Infrastructure (12 LP), Technology and Management in Construction (11 LP) as well as Geotechnical Engineering (9 LP) and the Bachelor Thesis (11 CP). These subjects consist of the modules with the same name respectively except the subject Structural Engineering, which consists of the two modules Basics of Reinforced Concrete and Basics in Steel and Timber Structures. The permission

to take the examinations for the subjects Structural Engineering, Water and Environment as well as Geotechnical Engineering requires the completion of all but two modules of the subjects Mechanics, Mathematics and Structural Design from the Basic Studies. The permission for the Bachelor Thesis requires a certificate about an internship in a construction company of at least eight weeks duration. It further requires the student to be in the 3rd regular year of study and to have completed all modules of the Basic Studies.
The **Compulsory Elective Part** includes 10 additional technical modules (2 CP each) from which 4 modules (8 CP in total) have to be taken.

Additional Studies

Furthermore, **Additional Accomplishments** can be taken voluntarily to an amount of maximum 30 CP. Modules from the total complete range of courses offered at KIT can be selected. In addition, up to 5 modules (30 CP max.) can be taken from a consecutive master degree programme as **master advance**, if the student has completed modules amounting to more than 120 CP. These can be credited in a master degree programme later on. This enables the student to customize content and time schedule of the interdisciplinary programme according to personal needs, interest and job perspective.

Curriculum of the Bachelor Degree Programme Civil Engineering - according to statutes for amendment from 14.01.2014 - state 04.03.2016

		Subject	Module	Course	Module code	type	1. SS HpW	2. SS HpW	3. SS HpW	4. SS HpW	5. SS HpW	6. SS HpW	Σ HpW	LC	CP
Basic Studies	Compulsory	Mechanics	Statics of Rigid Bodies		bauiBGP01-TM1	L/E	3/2						5	wE, 100 min., OE	7
			Strength of Materials		bauiBGP02-TM2	L/E		4/2					6	wE, 100 min.	9
			Dynamics		bauiBGP03-TM3	L/E			2/2				4	wE, 100 min.	6
			Hydromechanics		bauiBGP04-HYDRO	L/E			2/2				4	wE, 100 min.	6
		Mathematics	Analysis and Linear Algebra		bauiBGP05-HM1	L/E	4/2						6	wE, 90 min.	9
			Integration and Multivariate Analysis		bauiBGP06-HM2	L/E		4/2					6	wE, 90 min.	9
			Applied Statistics		bauiBGP07-STATS	L/E		2					2	wE, 60 min.	3
			Differential Equations		bauiBGP08-HM3	L/E			2/1				3	wE, 60 min.	4
		Building Materials		Theory of Building Materials	bauiBGP09-BSTOF	L/E		1/1					2	wE, 60 min., OE	3
				Building Materials		L/E			4/2				6	wE, 120 min.	9
		Structural Design		Building Physics	bauiBGP10-BKONS	L/E		1/1					2	wE, 60 min., OE	3
				Stuctural Design		L/E			2/2				4	wE, 90 min.	6
			Planning Methodology		bauiBGP11-PLANM	L/E	1/1						2	wA, 2x30 min.	2
			Project Management		bauiBGP12-PMANG	L/E	2						2	wA, 45 min.	2
			Geology in Civil Engineering		bauiBGP13-GEOL	L/E		2					2	wA, 20 min.	2
			Introduction to Computer Programming I		bauiBGP14-BINF1	L/E	1/1						2	wA, 30 min. (prerequisite: cert. Progr.Exerc.)	2
	SUM COMPULSORY						**17**	**20**	**21**				**58**		**82**
	Compulsory Elective		Key Competences		bauiBGW0-SQUAL			2	2				4		6
			Chemistry of Building Materials		bauiBGW1-BCHEM	L	2						2	wA, 30 min.	2
			Environmental Physics/ Energy		bauiBGW3-UPHYS	L	2						2	cert. exercises	2
			Technical Illustrations		bauiBGW5-TECDS	L/E	2						2	3 at home exercises, team exercises with presentat.	2
			Laboratory Course		bauiBGW6-LABOR	P	2						2	4 experiments	2
			Introduction to Computer Programming II		bauiBGW7-BINF2	L/E		1/1					2	wA, 30 min. (prerequisite: cert. Progr.Exerc.)	2
	SUM COMPULSORY ELECTIVE (at least 4 CP to be elected + 6 CP Key Qualific.)						**8**	**2**					**4+10**		**10**
	SUM 1. - 3. SS						**19-21**	**22-24**	**23**				**66**		**92**
Basic Subject / Consolidation Studies	Compulsory	Structural Analysis		Structural Analysis I	bauiBFP1-BSTAT	L/E				2/2			4	wE, 120 min.	5
				Structural Analysis II		L/E					2/2		4	wE, 120 min.	5
		Structural Engineering	Basics of Rein-forced Concrete	Basics of Reinforced Concrete I	bauiBFP2-KSTR.A	L/E					2/1		3	wE, 90 min.	4
				Basics of Reinforced Concrete II		L/E						2	2	wE, 60 min.	2
			Basics in Steel and Timber Structures	Basics in Steel Structures	bauiBFP3-KSTR.B	L/E					2/1		3	wE, 120 min.	9
				Basics in Timber structures		L/E					2/1		3		
		Water and Environment		Hydraulic Engineering and Water Management	bauiBFP4-WASSER	L/E					2/1		3	wE, 150 min.	12
				Hydrology		L/E					2/1		3		
				Sanitary Environmental Engineering		L/E						2/1	3		
		Mobility and Infrastructure		Spatial Planing and Planing Law	bauiBFP5-MOBIN	L/E				2/1			3	wE, 150 min. (prerequisite: 2 student research projects)	12
				Transportation		L/E				2/1			3		
				Design Basics in Highway Engineering		L/E				2/1			3		
		Technology and Management in Construction		Construction Technology	bauiBFP6-TMB	L/E				3/1			4	wE, 150 min.	11
				Economics in Construction Operation		L/E				2/1			3		
				Facility- and Real Estate Management		L				1			1		
		Geotechnical Engineering		Basics in Soil Mechanics	bauiBFP7-GEOING	L/E				2/2			4	wE, 150 min.	9
				Basics in Foundation Engineering		L/E					2/1		3		
			Bachelor Thesis		bauiBSC-THESIS							(7)	(7)	Thesis with presentation, 3 months	11
	SUM COMPULSORY									**25**	**22**	**5**	**52**		**80**
	Compulsory Elective		Partial Differential Equations		bauiBFW1-PDGL	L/E				1/1			2	wA, 60 min.	2
			Introduction to Continuum Mechanics		bauiBFW2-EKM	L						2	2	wA, 60 min.	2
			Physical Modelling in River Engineering		bauiBFW3-WASSVW	L						2	2	cert. experiment report	2
			Geotechnical Design		bauiBFW4-GEOPL	L						2	2	cert. student research project with colloqium	2
			Surveying		bauiBFW5-VERMK	L/E						1/1	2	cert. surveying exercise	2
			Project "Plan, Design, Engineering"		bauiBFW6-PPEK	Pj						2	2	team exercise	2
			Life Cycle Management		bauiBFW7-LZMAN	L/E						2	2	wA, 60 min.	2
			Basics of Track Guided Transport Systems		bauiBFW8-GSTS	L					2		2	wA, 60 min.	2
			Water Resources Management and Engineering Hydrology		bauiBFW9-WASSRM	L/E						2	2	wA	2
			Introduction to Computer Programming II		bauiBGW7-BINF2	L/E				1/1			2	wA, 30 min. (prerequisite: cert. Progr.Exerc.)	2
	SUM COMPULSORY ELECTIVE (at least 8 CP to be elected)									**4**	**2**	**14**	**20**		**8**
	SUM 4. - 6. SS									**25-29**	**22-24**	**7-13**	**60**		**88**
	MINIMUM SUM TOTAL 1. - 6. SS						**19**	**22**	**23**	**25**	**22**	**7**	**126**		**180**
Additional Studies	Elective		modules from the total offer of KIT (max. 30 CP)										0-20		0-30
			up to 5 modules from a consecutive Master Programme (max. 30 CP)										0-20		0-30
	MAXMUM SUM BACHELOR												**166**		**240**

SS = subject-related semester
HpW = (contact) hours per week
LC = Learning Control
CP = credit point

wE = written exam
wA = written attestation, not graded
OE = orientation exam

L = lecture
E = exercise
L/E = lecture and exercise, separate or integrated
P = practical training
Pj = project

Karlsruher Institut für Technologie

2 Useful tips and information

Module Handbook

The **module handbook** is the relevant document in which the structure of the programme is described and therefore it provides assistance for the orientation during the study. It describes the modules belonging to the programme and contains information about:

- the structure of the modules
- the extent of the modules (CP, HpW of the courses),
- interdependencies and required prerequisites of the modules
- the learning outcomes of the modules,
- the type of assessment of students' performance and examinations
- and the grading of a module.

In addition to the module handbook the **course catalogue** and the individual announcements of the institutes provide important information. These are updated every semester concerning variable course details (e.g. time and location of the course) as well as short-term modifications.

Selection and completion of a module

Every module and every course is allowed to be credited only once. The definite decision whether a compulsory elective module is selected is made by the student at the time of signing in for the corresponding examination. After attendance of the examination a module cannot be replaced by another module any more.
The module is **passed**, if the module examination has been passed (grade min 4.0). If the module examination consists of several partial examinations (e.g. Structural Analysis I and II), the module is passed once all partial examinations have been passed (grade min 4.0). Only then the minimum requirement of credits of this module has been met.

General examinations and partial examinations

Module examinations can be taken as a general examination or as several partial examinations. If the module examination is offered as a **general examination**, the entire content of the module will be reviewed in a single examination. If the module examination consists of **partial examinations**, the content of each course will be reviewed in corresponding partial examinations over several semesters.
The registration for the examinations takes place regularly online via the self-service function for students Campus Management for Students https://campus.studium.kit.edu. Theer, the following functions can be accessed:

- Sign in and sign off for examinations
- Retrieve examination results
- Print transcript of records

Repeating examinations, deadlines

In principal, a failed examination can be repeated once, latest by the end of the examination period of the next but one semester to this examination. If failing a written repeat examination an oral repeat examination can be taken. This is part of the overall repeat examination and will not be evaluated independently. After the oral repeat examination the overall grade of the repeat examination will be determined, either grade 4.0 (passed) or grade 5.0 (finally failed).
If the **repeat examination** (including an oral repeat examination) will be failed as well, the **examination claim** is lost. Requests for a second repetition of an examination have to be submitted to the examination committee immediately after losing the examination claim. Requests for a second repetition require the approval of the examination committee. A consultation with the examination committee is strongly recommended.
Orientation Examinations are the examinations in the module Statics of Rigid Bodies as well as the partial modules Theory of Building Materials and Building Physics. These have to be taken by the end of the examination

period of the second subject-related semester. Those who do not pass the Orientation Examinations including possible repeated examinations before the end of the examination period of the third subject-related semester will lose the examination claim in Civil Engineering. A second repetition of the Orientation Examinations is impossible. A possible request for an **extension of deadline** has to be submitted to the examination committee. This request is also decided by the examination committee.
Further information is available from the examination regulation of the programme, the examination committee or the "Fachschaft" (student council).

Changes in module offer

The offer of modules changes in the course of the semesters. Modules can be discontinued or added or the module examination may change. If possible, such changes are announced in the module handbook with sufficient time in advance, at latest at the beginning of the semester as from they are valid. Usually, it is valid that students started a module (s. selection and completion of a module) can complete this in that form as started. The respective examinations are provided onwards over a certain time period usually at least one semester after time of change. In general, a consultation with the examiner is recommended in case that an examination has to be taken in a module not offered any more.

Key Competences

In order to get the credits, 6 CP, for the module Key Competences, usually, respective courses from the offer of the House of Competence (HoC) and the Centre for Cultural and General Studies (ZAK) have to be selected. In special cases the examination committee can accept further suitable courses as key competences which are not included in the offers of HoC and ZAK as mentioned above.
The module Key Competences is completed without grade. After consultation with the lecturer a grade can be reported but is not included in the general grade.

Additional accomplishments, master advance

An **additional accomplishments** is a voluntarily taken examination. The results are not used for the calculation of the overall grade of the student. It has to be registered as such at the Students Service. It cannot be taken as compulsory or compulsory elective accomplishment later on. For the transfer of grades the respective ”Blue Sheet” has to be delivered to examiner in advance to the examination. Additional accomplishments may be selected from the entire KIT catalogue and are limited to a maximum of 30 credit points in total. They are listed in the Transcript of Records. Upon request by the student they can be mentioned in the Bachelor Certificate.
In addition, up to five modules, 30 credits resp., may be selected as **master advance** from the master study programmes of Civil Engineering, Mobility and Infrastructure or Functional and Construction Engineering, once 120 credits have been completed within the Bachelor’ studies. This is to allow for a simpler transition to the consecutive master programme outside the regular period of study. It has to be registered also at the Students Service. For the transfer of grades the respective ”Blue Sheet” has to be delivered to examiner in advance to the examination.
Please note that these modules are transferred only by request to a master programme and not automatically. The template for the request (in German) can be downloaded from the webpage http://www.sle.kit.edu/imstudium/antraege-formulare.php. The request has to be submitted to the Students Service at the beginning of the master studies, i.e. within the first semester.

Further information

More detailed information about the legal and general conditions of the programme can be found in the examination regulation of the programme (as of 8.9.2009), and in the statutes for amendment of the examination regulation (as of 24.3.2011, 14.1.2014 and 28.3.2014 (Art. 3), http://www.sle.kit.edu/imstudium/bachelor-bauingenieurwesen.php).

Contact persons

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Abbreviations

LP/CP	Credit Points	Leistungspunkte
LV	course	Lehrveranstaltung
P	practical training	Praktikum
Pj	project	Projekt
S	summer term	Sommersemester
Sem.	semester/term	Semester
ER/SPO	examination regulations	Studien- und Prüfungsordnung
KC/SQ	key competences	Schlüsselqualifikationen
HpW/SWS	contact hour per week	Semesterwochenstunde
E/Ü	excercise course	Übung
L/V	lecture	Vorlesung
W	winter term	Wintersemester

3 Actual Changes

Important changes are pointed out in this section in order to provide a better orientation. Although this process was done with great care, other/minor changes may exist.

As from SoSe 2016 the module Introduction to Computer Programming II [bauiBGW7] can also be selected as compulsory elective module within the Basic Subject Studies.

The term paper in Spatial Planning and Planning Law within the module Mobility and Infrastructure [bauiBFP5-MOBIN] is no longer required as examination prerequisite.

4 Modules

4.1 Compulsory Modules Basic Studies

Module: Statics of Rigid Bodies [bauiBGP01-TM1]

Coordination: P. Betsch
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 1

ECTS Credits	Cycle	Duration
7	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200101	Statics of Rigid Bodies	L/E/T	3/2/2	W	7	P. Betsch, T. Seelig

Learning Control / Examinations
graded:
examination Statics of Rigid Bodies, written, 100 min., accord. ER/SPO § 4 par. 2 no. 1, part of orientation exam, accord. ER/SPO § 8 par. 1
grading:
grade of module is defined by grade of examination

Conditions
none

Recommendations
none

Qualification Goals
The basic concepts of the performance of structures carrying loads is taught using the model of rigid bodies. Relying on a few basic principles of physics, starting from simple bodies, systems of rigid bodies are investigated. Synthetic and analytic approaches and their realization in engineering methods are presented. In connection with principle methodical approaches the investigation of technical systems, especially of civil engineering structures is in the centre of the lecture. In addition, a major goal is the independent learning of the subjects taught, supported by classroom exercises and voluntary supervised group exercises.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises, tutorials:	105 h
independent study:	
preparation and follow-up, examination preparation:	105 h
total:	210 h

Content

- Operations with forces – force systems -Method of sections
- Equilibrium of coplanar/spatial force systems
- Force systems, acting on bodies - resultants
- Force couple - moments
- Reduction of spatial force systems
- Equilibrium of rigid bodies
- Technical tasks – conventions for support and support conditions – statically determined support, equilibrium conditions
- Centroid of an assemblage and of continuous quantities, distributed loads/area loads
- Coplanar systems of rigid bodies – technical systems
- Internal forces and moments
- Ideal truss systems – buildup principle – Ritter's method of sections
- Section forces in beams – distribution of internal forces and moments – differential equation

- The principle of superposition
- Friction stick and slip (static and kinetic) – belt friction
- Work and energy - energy methods
- Kinematics of coplanar motion – the principle of virtual work
- Potential force, potential principles of work and energy
- Stable and unstable equilibrium, stability

Remarks
Literature:
Gross / Hauger / Schröder Wall - Technische Mechanik 1

Module: Strength of Materials [bauiBGP02-TM2]

Coordination: T. Seelig
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 2

ECTS Credits	Cycle	Duration
9	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200201	Strength of Materials	L/E/T	4/2/2	S	9	P. Betsch, T. Seelig

Learning Control / Examinations
graded:
examination Strength of Materials, written, 100 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by grade of examination

Conditions
none

Recommendations
It is recommended to attend the module Statics of Rigid Bodies [bauiBGP01-TM1] previously.

Qualification Goals
Analysis of stresses and strains in one-dimensional structural member. Deformations of statically determinate and indeterminate structures can finally be computed. The students should then be able to judge arbitrary stress and strain states in structures concerning yield and fracture. The students should also be able to use energy principles for the solution of standard problems as well as for simple beam buckling problems.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises, tutorials:	120 h
independent study:	
preparation and follow-up, examination preparation:	150 h
total:	270 h

Content

- Tension / compression in bars – stresses/ strains/constitutive equations
- Differential equation for bar
- Statically indeterminate problems
- Deformations – statically determinate truss systems
- Analysis of statically determinate truss systems
- Combined stress state – stress vector/ stress tensor
- Principle stresses – Mohr's circle of stress – transformation of stresses and strains
- Differential equations – plane stress state
- Strain state, relation between stresses and strains – elastic materials
- Yield and fracture criteria
- Beam bending – kinematic assumption and limitations of the theory
- Moments of inertia – principle axes of inertia
- Basic equations of pure bending – symmetrical cross section
- Normal stresses as the result of bending
- Differential equations for beam bending, moment distribution -Single- and multi-field beam structures/superposition law
- Shear stresses – prismatic, thin-walled open cross-sections
- Bending combined with normal force/skew bending unsymmetrical cross sections – temperature loading

- Torsion bar with circular cross section – thin-walled closed cross sections
- Energy methods and deformation energy
- Principle of virtual forces – truss systems, beam bending
- Influence coefficients – Betti-Maxwell principle
- Application of energy methods to statically indeterminate systems
- Stability and buckling of beams

Remarks
Literature:
Gross / Hauger / Schröder Wall - Technische Mechanik 2

Module: Dynamics [bauiBGP03-TM3]

Coordination: T. Seelig
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 3

ECTS Credits	Cycle	Duration
6	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200301	Dynamics	L/E/T	2/2/2	W	6	T. Seelig, P. Betsch

Learning Control / Examinations
graded:
examination Dynamics, written, 100 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by grade of examination

Conditions
none

Recommendations
It is recommended to attend the following modules previously:
Statics of Rigid Bodies [bauiBGP01-TM1]
Strength of Materials [bauiBGP02-TM2]

Qualification Goals
The major goal of the course are several selected themes of the classical kinetics that are of particular interest in the field of civil engineering. The basics of vibration theory are taught and provide first insight and understanding of the most important oscillation phenomena in civil engineering structures.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises, tutorials:	90 h
independent study:	
preparation and follow-up, examination preparation:	90 h
total:	180 h

Content

- Kinematics of a single mass point (cartesian, polar and natural coordinates)
- Kinetics of a single mass point: Newton's fundamental law, equations of equilibrium
- Work-energy equation
- Principle of linear momentum (impact law)
- Plane relative motion -Kinematics and kinetics of rigid bodies (moments of inertia, principle of angular momentum)
- Systems of rigid bodies: synthetic and analytic (Lagrangian equations and approaches, constraints, the degree of freedom, potential and non-potential forces)
- Introduction into linear vibration theory: mechanical models, free and focused vibrations of 1 DOF-systems, vibration of 2 DOF-systems

Remarks
Literature:
Vielsack - lecture notes "Dynamik"
Gross / Hauger / Schröder Wall - Technische Mechanik 3

Module: Hydromechanics [bauiBGP04-HYDRO]

Coordination: O. Eiff
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 3

ECTS Credits	Cycle	Duration
6	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200304	Hydromechanics	L/E	2/2	W	6	O. Eiff

Learning Control / Examinations
graded:
examination Hydromechanics, written, 100 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by grade of examination

Conditions
none

Recommendations
It is strongly recommended to have completed the following modules previously:
Analysis and Linear Algebra [bauiBGP05-HM1]
Integration and Multivariate Analysis [bauiBGP06-HM2]
Statics of Rigid Bodies [bauiBGP01-TM1]

Qualification Goals
The students are able to identify and explain the fundamental concepts and relations in fluid mechanics. They are able to apply these concepts and relations to solve simple fluid mechanical problems. In their professional lives, the students can effectively use an introductory textbook on fluid mechanics, such as the one proposed, to obtain estimates and find solutions for fluid-flow related problems, with confidence.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises:	60 h
independent study:	
preparation and follow-up, examination preparation:	120 h
total:	180 h

Content

- properties of fluids
- fluid statics: pressure distribution in stagnant fluids, buoyancy
- the Bernoulli equation
- flow kinematics: velocity and acceleration fields, control volumes, Reynolds transport theorem
- finite control volume analysis: conservation of mass, momentum and energy
- introduction to differential analysis of fluid flow
- dimensional analysis, similitude and modeling
- viscous flows in pipes
- flow over immersed bodies
- open-channel flows

Remarks
Literature:
Munson, B.R., Okiishi, T.H. Huebsch, W. W., Rothmayer, A. P. (2010) Fluid Mechanics SI Version, 7th edition, Wiley.
Jirka, Gerhard H. (2007). Einführung in die Hydromechanik, Universitätsverlag Karlsruhe, Karlsruhe. http://digbib.ubka.uni-karlsruhe.de/volltexte/1000007165

Module: Analysis and Linear Algebra [bauiBGP05-HM1]

Coordination: M. Hochbruck, V. Grimm, M. Neher
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 1

ECTS Credits	Cycle	Duration
9	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
0131900	Analysis and Linear Algebra	L/E/T	4/2/2	W	9	M. Hochbruck, V. Grimm, M. Neher

Learning Control / Examinations
graded:
examination Analysis und Linear Algebra, written, 90 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by grade of examination

Conditions
none

Recommendations
none

Qualification Goals
The students

- obtain fundamental knowledge of linear algebra and of differentiation of functions of one variable,
- master the mathematical concepts required in qualitative and quantitative modelling in engineering,
- become able to apply the covered methods for mathematical modelling of engineering problems self-reliantly and with confidence and to solve the resulting mathematical problem with the selected tools

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises, tutorials:	120 h
independent study:	
preparation and follow-up, examination preparation:	150 h
total:	270 h

Content

- numbers and basic arithmetic rules
- propositional calculus
- vectors and matrices
- linear systems of equations
- eigenvalues and eigenvectors of matrices
- sequences and series
- real valued functions
- continuity
- differentiation of functions of one variable
- extreme values
- parametric representation of plane curves
- approximation and interpolation

Remarks
Literature:
T. Arens et al.: Mathematik. Spektrum-Verlag, 2008.
T. Westermann: Mathematik für Ingenieure. Springer, 5. Aufl. 2008.

Module: Integration and Multivariate Analysis [bauiBGP06-HM2]

Coordination: M. Hochbruck, V. Grimm, M. Neher
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 2

ECTS Credits	Cycle	Duration
9	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
0181300	Integration and Multivariate Analysis	L/E/T	4/2/2	S	9	M. Hochbruck, V. Grimm, M. Neher

Learning Control / Examinations
graded:
examination Integration and Multivariate Analysis, written, 90 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by grade of examination

Conditions
none

Recommendations
It is recommended to attend the module Analysis and Linear Algebra [bauiBGP05-HM1] previously.

Qualification Goals
The students

- obtain fundamental knowledge of differentiation of functions of several variables and of integration of functions of one or several variables,
- master the mathematical concepts required in qualitative and quantitative modelling in engineering,
- become able to apply the covered methods for mathematical modelling of engineering problems self-reliantly and with confidence and to solve the resulting mathematical problem with the selected tools

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises, tutorials:	120 h
independent study:	
preparation and follow-up, examination preparation:	150 h
total:	270 h

Content

- integration of functions of one variable
- numerical quadrature
- improper integrals
- applications requiring integral calculus
- functions of several variables
- differentiation of functions of several variables
- extreme values of functions of several variables
- Taylor's theorem
- Newton's method
- line and surface integrals of scalar functions

Remarks
Literature:
T. Arens et al.: Mathematik. Spektrum-Verlag, 2008.
T. Westermann: Mathematik für Ingenieure. Springer, 5. Aufl. 2008.

Module: Applied Statistics [bauiBGP07-STATS]

Coordination: J. Ihringer
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 2

ECTS Credits	Cycle	Duration
3	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200204	Applied Statistics	L/E	2	S	3	J. Ihringer

Learning Control / Examinations
graded:
examination Applied Statistics, written exam, 60 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by grade of examination

Conditions
none

Recommendations
none

Qualification Goals
The Students will get knowledge about the basics for application of statistical Methods in Civil Engineering. With this knowledge they will be able to select and apply statistical Methods for specific problems and will be able to perfomr and discuss the calculation and results.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures/exercises:	30 h
independent study:	
preparation and follow-up, examination preparation:	60 h
total:	90 h

Content

- objektives of statistical analysis and terminology
- statistical values and frequency distribution
- change from frequency distribution to likelihood
  random sample and basic population
  probability density function and probability density distribution function
  calculation with probabilities
- discrete random variable
  selected probability density functions
- continuous random variable
  selected probability density functions
  transformation of probability density distributions
- evaluative statistics
  parameter estimation, estimation error, confidenz intervalls and theorie of testing
- regression analysis
  two-dimensional probability density distribution
  linear regression analysis and correlation analysis

Remarks
Literature:
Kreyszig, E.: Statistische Methoden und ihre Anwendung; Verlag Vandenhoeck und Ruprecht
Plate, E. (1993): Statistik und angewandte Wahrscheinlichkeitslehre für Bauingenieure, Verlag Ernst und Sohn, Berlin
Sachs, L. (1969): Statistische Auswertemethoden; Springer-Verlag

Module: Differential Equations [bauiBGP08-HM3]

Coordination: M. Hochbruck, V. Grimm, M. Neher
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 3

ECTS Credits	Cycle	Duration
4	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
0132200	Differential Equations	L/E	2/1	W	4	M. Hochbruck, V. Grimm, M. Neher

Learning Control / Examinations
graded:
examination Differential Equations, written exam, 60 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by grade of examination

Conditions
none

Recommendations
It is recommended to attend the following modules previously:
Analysis and Linear Algebra [bauiBGP05-HM1]
Integration and Multivariate Analysis [bauiBGP06-HM2]

Qualification Goals
The students

- obtain fundamental knowledge of ordinary differential equations, including numerical method,
- become familiar with partial differential equations of second order,
- master the mathematical concepts required in qualitative and quantitative modelling in engineering,
- become able to apply the covered methods for mathematical modelling of engineering problems self-reliantly and with confidence and to solve the resulting mathematical problem with the selected tools

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises:	45 h
independent study:	
preparation and follow-up, examination preparation:	75 h
total:	120 h

Content

- ordinary differential equations (ODEs)
- linear ODEs
- systems of ODEs
- elementary ODEs
- power series solutions of ODEs
- numerical methods for ODEs
- boundary problems and eigenvalue problems
- Fourier series
- partial differential equations of second order

Remarks
Literature:
T. Arens et al.: Mathematik. Spektrum-Verlag, 2008.
T. Westermann: Mathematik für Ingenieure. Springer, 5. Aufl. 2008.

Module: Building Materials [bauiBGP09-BSTOF]

Coordination: H. Müller
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 2+3

ECTS Credits	Cycle	Duration
12	Every 2nd term, Summer Term	2

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200206	Theory of Building Materials	L/E	1/1	S	3	H. Müller
6200306	Building Materials	L/E	4/2	W	9	H. Müller

Learning Control / Examinations
graded:
partial examination Theory of Building Materials, written, 60 min., accord. ER/SPO § 4 par. 2 no. 1, part of orientation exam, accord. ER/SPO § 8 par. 1
partial examination Building Materials, written, 120 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by weighted average according credit points of grades of the partial examinations

Conditions
none

Recommendations
none

Qualification Goals
The students are made familiar with the fundamental terms of material science and the specific properties of numerous building materials. They obtain profound knowledge of the physical, chemical and mechanical relations, which result from the material structure and its time- and load-dependent modification. By using the learnt basic knowledge the students gain insight into methods of production, moulding, processing and protection of the durability of building materials. Furthermore, an understanding of the general procedures when selecting applicable materials is given to the students, considering environmental aspects and sustainability. Their understanding of certain building material phenomena is promoted by several examples from building practice.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
Theory of Building Materials lectures, exercises:	30 h
Building Materials lectures, exercises:	90 h
independent study:	
preparation and follow-up, examination preparation:	240 h
total:	360 h

Content
In this module the fundamental terms and the essential properties of building materials are introduced. Firstly the building materials are classified. Based on this classification, the principal physical and mechanical properties as well as the most important characteristical parameters are specified. Furthermore, the basic knowledge about the atomic structure and its influence on the physical and mechanical properties of the material is given.
For important materials, commonly used in building and construction (e. g. steel, concrete, ceramics, glasses, polymers, timber, bituminous materials), the fundamental terms and essential properties of the materials are supplemented and exemplified. Especially the production and the source materials as well as their influence on the rheological and mechanical properties are in the focus of interest. Damage types and processes in connection with the durability of building materials are another essential part of the module. In addition the legal regulations regarding testing, supervision and certification of building materials are briefly introduced.

Remarks
Literature:
lecture notes “Baustoffkunde und Konstruktionsbaustoffe”
additional references in respective scriptum included

Module: Structural Design [bauiBGP10-BKONS]

Coordination: H. Müller, H. Blaß
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 2+3

ECTS Credits	Cycle	Duration
9	Every 2nd term, Summer Term	2

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200208	Building Physics	L/E	1/1	S	3	H. Müller
6200308	Structural Design	L/E/T	2/2/2	W	6	H. Blaß

Learning Control / Examinations
graded:
partial examination Building Physics, written, 60 min., accord. ER/SPO § 4 par. 2 no. 1, part of orientation exam, accord. ER/SPO § 8 par. 1
partial examination Structural Design, written, 90 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by weighted average according credit points of grades of the partial examinations

Conditions
none

Recommendations
none

Qualification Goals
Attending the two lectures „Building Physics“ and „Structural Design” the students gain a basic knowledge on the design of different structures considering the normative requirements regarding the preservation of structures.
By the lecture “Structural Design” the students get to know the basis of design, the safety concept and the process of structural design for buildings. They know the different structural components like roof structures, floor and wall structures as well as foundations. The students get the idea of the load transfer and the distribution of forces in structures. The students are able to determine loads on structures, to persecute the loads to the foundation based on the choice of load elements and to prove simple elements. They know the functionality of load elements and are able to design simple structures.
By the lecture “Building Physics” and the corresponding tutorials the students get a comprehensive understanding of physical problems concerning heat protection, moisture protection, noise control and fire protection. They get to know the normative requirements regarding the preservation of structures and the related methods of calculation. Based on various examples the students also learn about the realization of these requirements in the praxis of construction.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
Building Physics lectures, exercises:	30 h
Structural Design lectures, exercises, tutorials:	90 h
independent study:	
preparation and follow-up, examination preparation:	150 h
total:	270 h

Content
Lecture Building Physics:

- Introduction: Climate, hygiene in housing, security, environment and energy.
- Heat insulation: stationary and non-stationary heat transport, thermal bridges, heat insulation of buildings, energy saving regulation, construction examples.
- Moisture protection: moisture storage and moisture transport, formation of condensate, normative calculation methods, construction examples, development of molds.
- Noise control: acoustic measurements, sound propagation, airborne and structure-borne sound insulation, noise control according to standard, construction examples.
- Fire protection: fire process, behaviour of building materials and construction units in case of fire, calculation of fire resistance, guidelines and regulations.

Lecture Structural Design:

- Basis of design and safety concept: Design concepts, safety standards for structures
- Load bearing systems: Elements, bracings
- Actions on structures: Permanent, live and exceptional loads
- Roof constructions: Steep roofs, flat roofs
- Floor constructions: Reinforced concrete, steel, timber
- Wall constructions: Dimensions, brickwork, timber, design
- Stairs: Standards for stairs, design of stairs
- Foundations: Pad foundations, base failure, tilting, sliding, stresses

Remarks
Literature:
lecture notes “Bauphysik”
Lutz, Jenisch, Klopfer et. al: Lehrbuch der Bauphysik. Schall, Wärme, Feuchte, Licht, Brand, Klima. Teubner Verlag
Hohmann, Setzer, Wehling: Bauphysikalische Formeln und Tabellen. Wärmeschutz, Feuchteschutz, Schallschutz. Werner Verlag
Gösele, Schüle, Künzel: Schall, Wärme, Feuchte. Grundlagen, neue Erkenntnisse und Ausführungshinweise für den Hochbau. Bauverlag
lecture notes “Baukonstruktionslehre”
Lehrbuch der Hochbaukonstruktionen (ed.: Cziesielski, Erich)
Baukonstruktion im Planungsprozess (ed.: Franke, Lutz)
Porenbetonhandbuch
Informationsdienst Holz, Holzbau Handbuch, Reihe 2, Teil 3 - Dachbauteile, Folge 1 - Berechnungsgrundlagen
Informationsdienst Holz, Holzbau Handbuch, Reihe 2, Teil 3 - Dachbauteile, Folge 2 - Hausdächer

Module: Planning Methodology [bauiBGP11-PLANM]

Coordination: P. Vortisch
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 1

ECTS Credits	Cycle	Duration
2	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200104	Planning Methodology	L/E	1/1	W	2	P. Vortisch, T. Soylu

Learning Control / Examinations
attested:
attestation part A, written, 30 min., accord. ER/SPO § 4 par. 2 no. 3
attestation part B, written, 30 min., accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a., but both attestation parts have to be passed separately

Conditions
none

Recommendations
none

Qualification Goals
Learning and understanding of general terms and relationships and general methods and techniques in the field of spatial and infrastructure planning. The module forms an first access into the field of planning (theory, methodologies) at the examples of transport and spatial planning.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises:	30 h
independent study:	
preparation and follow-up, attestation preparation:	30 h
total:	60 h

Content
Basic concepts and relationships about the methodologies of planning will be mediated, e.g.:

- typologies of planning
- planning systems
- sequences of acting and its coordination
- dealing with scare resources
- need for forecasts
- uncertainty in planning
- simple forecasting approaches
- evaluation methodologies
- sensitivity analyses (approaches and applications)

Remarks
Literature:
lecture notes
Fürst, D.; Scholles, F. (Hrsg.) 2008: Handbuch Theorien und Methoden derraum-und Umweltplanung; Detmold: Dorothea Rohn

Module: Project Management [bauiBGP12-PMANG]

Coordination: S. Haghsheno
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 1

ECTS Credits	Cycle	Duration
2	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200106	Project Management	L/E	2	W	2	S. Haghsheno, H. Schneider

Learning Control / Examinations
attested:
attestation Project Management, written, 45 min., accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
none

Qualification Goals
After this module the students have basic knowledge in the subject of project management, particular in the field of project management in civil construction.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures/exercises:	30 h
independent study:	
preparation and follow-up, attestation preparation:	30 h
total:	60 h

Content
This module gives an introduction into the concepts project management. The general organisation of projects (particular in civil engineering) and the description of the different phases of projects were imparted as well as the three main parts of project management, namely time, cost an quality management.

Remarks
Literature:
DIETHELM, G.: Projektmanagement, Band 1: Grundlagen, Verlag Neue Wirtschafts-Briefe, Herne, 2000
HAHN, R.: Projektmanagement für Ingenieure, Wiley-VCH Verlag, Weinheim, 2002
KERZNER, H.: Project Management – A Systems Approach to Planning, Scheduling and Controlling, Wiley & Sons, 2006
KOCHENDÖRFER, B., LIEBCHEN, J.: Bau-Projekt-Management, Verlag B. G. Teubner, Stuttgart, 2001

Module: Geology in Civil Engineering [bauiBGP13-GEOL]

Coordination: J. Eckhardt
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 2

ECTS Credits	Cycle	Duration
2	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200210	Geology in Civil Engineering	L/E	2	S	2	J. Eckhardt, T. Mutschler

Learning Control / Examinations
attested:
attestation Geology in Civil Engineering, written, 20 min., accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
none

Qualification Goals
Getting to know the common basis for a cooperation of civil engineers and geologists.
Understanding the system earth, its structure and dynamics.
Recognizing the most important kinds of rock.
Introduction to geological investigation methods.
Knowledge of basics in hydrogeology.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures/exercises:	30 h
independent study:	
preparation and follow-up, attestation preparation:	30 h
total:	60 h

Content

- Introduction
- Movement, shape, structure, exogenous and endogenous dynamics of the earth
- Crystals, minerals, rocks and formations
- Magmatic rocks
- Metamorphic rocks
- Sedimentary rocks
- Genesis, classification and addressing of soil and rock formation
- Geology and ground properties
- Basics of tectonics
- Representation of stratification planes and cleaving
- Geological investigation and methodology
- Basics of hydrogeology

Remarks
Literature:
Press, F. & Siever, R. (2003): Allgemeine Geologie, 3. Aufl., Spektrum
Fecker, E. & Reik, G. (1996): Baugeologie, 2. Aufl., F. Enke

Module: Introduction to Computer Programming I [bauiBGP14-BINF1]

Coordination: M. Uhlmann
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 1

ECTS Credits	Cycle	Duration
2	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200114	Introduction to Computer Programming I	L/E	1/1	W	2	M. Uhlmann

Learning Control / Examinations
attested:
attestation Introduction to Computer Programming I, written, 30 min., accord. ER/SPO § 4 par. 2 no. 3
prerequisite: attested programming exercises, accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
none

Qualification Goals
Participants receive a fundamental understanding of digital data processing. They are capable of tackling problems of data processing independently, which involves the capacity to learn to use new software tools on their own. Participants will aquire basic programming skills.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises:	30 h
independent study:	
programming exercises, attestation preparation:	30 h
total:	60 h

Content

- Fundamentals of digital data processing: Information and coding, data structures, algorithms, computer architectures
- Introduction to programming: Basic elements of high-level programming languages, structured programming, practical examples
- Software applications: Operating systems, selected software applications of interest for engineers

Remarks
Literature/Study Materials:
J.G. Brookshear, “Computer Science: An Overview”, Pearson, 2009;
B.W. Kernighan and D.M. Ritchie, “The C Programming Language”, Prentice Hall, 1988;
S. Prata, “C++ Primer Plus”, Sams, 2005;
J. Liberty and B. Jones, “Teach yourself C++ in 21 days”, Sams, 2005;
RRZN, “Die Programmiersprache C”, 2008 (Skriptenverkauf am SCC)
RRZN, “C++ für C Programmierer”, 2005 (Skriptenverkauf am SCC)

4.2 Compulsory Elective Modules Basic Studies

Module: Key Competences [bauiBFW0-SQUAL]

Coordination: Studiendekan Bauingenieurwesen
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject:

ECTS Credits	Cycle	Duration
6	Every term	

Learning Control / Examinations
according to elected courses, freely be chosen from the course catalogue for Key Competences of HoC and ZAK
Marking:
n. a.
(marks can be requested in agreement with lecturer, but do not contribute to overall grade)

Conditions
none

Recommendations
none

Qualification Goals
Learning outcomes can be divided into three main complementary categories:
1. Contextual Knowledge

- Students are aware of the cultural context of their position and are in a position to consider the views and interests of others (beyond the boundaries of subject, culture, and language).
- They have enhanced their ability to participate properly and appropriately in academic or public discussions.

2. Practical Focus

- Students have gained an insight into the routines of professional life.
- They have further developed their capability to learn.
- They have improved their scope of action by extending their knowledge of foreign languages.
- They are able to relate their field of experience to basic aspects of business administration and law.

3. Basic Competences

- The students autonomously acquire new knowledge in a planned, specific, and methodologically founded manner and use it for solving tasks and problems.
- They can evaluate own work.
- They possess efficient work techniques, can set priorities, take decisions, and assume responsibility.

Workload
see module handbook of HoC, and lecture descriptions of ZAK

Content
With the key competences, the House of Competence and the Centre for Cultural and General Studies (ZAK) offer a wide range of courses, which are bundled thematically for better orientation. The contents are explained in detail in the descriptions of the courses on the internet pages of HoC (http://www.hoc.kit.edu/lehrangebot.php) and ZAK (http://www.zak.kit.edu/english/general_studies.php).

Remarks
The Examination Committee can recognize further suitable courses as key competences which are not listed in the offers of Hoc and ZAK as mentioned above.

Module: Chemistry of Building Materials [bauiBGW1-BCHEM]

Coordination: J. Eckhardt
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 1

ECTS Credits	Cycle	Duration
2	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200108	Chemistry of Building Materials	L	2	W	2	J. Eckhardt

Learning Control / Examinations
attested:
attestation Chemistry of Building Materials, wirtten, 30 min., accord. ER/SPO § 4 Par. 2 No. 3
grading:
n. a.

Conditions
none

Recommendations
none

Qualification Goals
The student will be imparted topics of general and inorganic chemistry, which are partly teached at high school during the last two years. Particular attention is paid to chemical aspects in the building material, which provide the basis for further studies (M.Sc.) and are essential in building practice.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures:	30 h
independent study:	
preparation and follow-up, attestation preparation:	30 h
total:	60 h

Content

- Atomic structure and the periodic table of elements
- chemical bonding
- boundary conditions of substances
- stoichiometry and examples from the construction: chemical reactions, chemical equilibrium (law of mass action)
- electrolytes and non electrolytes
- cementitious materials
- redox reaction
- solutions, colloids, dispersions, emulsions
- silicate chemistry, silicates in construction

Remarks
Literature:
Erwin Riedel: Allgemeine und Anorganische Chemie, Gruyter Verlag

Module: Environmental Physics / Energy [bauiBGW3-UPHYS]

Coordination: F. Nestmann
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 1

ECTS Credits	Cycle	Duration
2	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200112	Environmental Physics / Energy	L	2	W	2	F. Nestmann

Learning Control / Examinations
ungraded:
attestation Environmental Physics / Energy, attested exercises, accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
none

Qualification Goals
The students are capable of environmental phenomena. They can describe the use of forces from the natural envoironment in the sense of energy recovery.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures:	30 h
independent study:	
preparation and follow-up, preparation of exercises:	30 h
total:	60 h

Content

- Defintion of energy
- natural ressources
- regenerative and non-regenerative kinds of energy
- energy balance
- production of electric energy: water power, wind energy, solar energy, geothermal power plants, conventional power plants
- environmental transport-cycles
- presentation of ongoing research projects at KIT

Module: Technical Illustrations [bauiBGW5-TECDS]

Coordination: R. Roos
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 1

ECTS Credits	Cycle	Duration
2	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200116	Technical Illustrations	L/E	2	W	2	R. Roos

Learning Control / Examinations
attested:
attestation Technical Illustrations, 3 term papers, 1 group exercize with presentation (10 minutes), accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
none

Qualification Goals
The graduates are able to apply illustration techniques for engineering problems and to use them within written reports, for the preparation of supplementary material for public relations activities and for presentations. They can work self-organized and are equipped with organisational and didactical competences related to team work and presentations.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises:	22.5 h
independent study:	
preparation and follow-up	5.5 h
homework:	18.0 h
team exercise:	15.0 h
total:	61 h

Content
Within this module the theoretical basics of central perspective, 2-view projection and “kotierte Projektion”, inIllustration techniques (sketches, free-style drawing, modell etc.), way illustrating (free-style drawing, coputer-aided) as well as methods of presentations are presented and partially trained.

Module: Laboratory Course [bauiBGW6-LABOR]

Coordination: P. Vortisch
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 1

ECTS Credits	Cycle	Duration
2	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200118	Laboratory Course	P	2	W	2	staff of participating institutes

Learning Control / Examinations
attested:
attestation Laboratory Course, participation at 4 chosen experiments in 4 institutes, accord. ER/SPO § 4 par. 2 no. 3
Marking:
n. a.

Conditions
For some experiments group sizes are defined (minimum and maximum number of participants).

Recommendations
none

Qualification Goals
The main goal is to gain basic knowledge in laboratories of different fields and experience of practical work of specific institutes. The experiments can be chossen individually according to personal interest.

Workload

contact hours:	
laboratory work (4 x 2 x 4 h):	32 h
independent study:	
preparation and follow-up, experiment report:	20 h
total:	52 h

Content
Carrying out practical laboratory training in different fields:

- Construction Engineering: experiments on construction, modelling und load capacity of structures, structural components and connections
- Water and Environment: experiments on energy use, pressure and velocity distributiuons in flows, water and waste water treatment
- Mobility and Infrastructure: analysis of von asphalt road, traffic analysis
- Technologie and Management in Construction Operation: vibration/shock mesurements
- Geotechnical Engineering: experiments on shear strength

Module: Introduction to Computer Programming II [BauiBGW7-BINF2]

Coordination: M. Uhlmann
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 2, compulsory elective semester 4

ECTS Credits	Cycle	Duration
2	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200212	Introduction to Computer Programming II	L/E	1/1	S	2	M. Uhlmann

Learning Control / Examinations
attested:
attestation Introduction to Computer Programming II, written, 30 min., accord. ER/SPO § 4 par. 2 no. 3
prerequisite: attested programming exercises, accord. ER/SPO § 4 par. 2 no. 3
Marking:
n. a.

Conditions
attendance of "Introduction to Computer Programming I" [bauiBGP14-BINF1]

Recommendations
none

Qualification Goals
Participants deepen their understanding of digital data processing and of the algorithmes involved therein. They will enhance their programming skills, particularly with respect to object-oriented programming; they will apply this to practical tasks.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises:	30 h
independent study:	
programming exercises, attestation preparation:	30 h
total:	60 h

Content

- Introduction to object-oriented programming: basic elements of object-oriented programming languages and their realisation with one particular high-level programming language
- Practical examples of the implementation of common algorithms, application to problems of interest for engineers

Remarks
As from SoSe 2016 the module can be selceted as compulsory elective module within the Basic Studies as well as within the Basic Subject Studies.

Literature/Teaching Materials:
S. Prata, "C++ Primer Plus", Sams, 2005;
J. Liberty and B. Jones, "Teach yourself C++ in 21 days", Sams, 2005;
R. Lischner, "C++ in a Nutshell", O'Reilly, 2003;
RRZN, "C++ für C Programmierer", 2005 (Skriptenverkauf am SCC)

4.3 Compulsory Modules Basic Subject Studies

Module: Structural Analysis [bauiBFP1-BSTAT]

Coordination: W. Wagner
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 4+5

ECTS Credits	Cycle	Duration
10	Every 2nd term, Summer Term	2

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200401	Structural Analysis I	L/E/T	2/2/1	S	5	W. Wagner
6200501	Structural Analysis II	L/E/T	2/2/1	W	5	W. Wagner

Learning Control / Examinations
graded:
partial examination Structural Analysis I, written, 120 min., accord. ER/SPO § 4 par. 2 no. 1
partial examination Structural Analysis II, written, 120 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by weighted average according credit points of grades of the partial examinations

Conditions
keine

Recommendations
It is recommended to attend the following modules previously:
Statics of Rigid Bodies [bauiBGP01-TM1]
Strength of Materials [bauiBGP02-TM2]

Qualification Goals
Students will learn the essential principles for modeling and calculation of 2D- and 3D-beam structures. This allows the calculation of displacement and stress resultant fields for the design and construction of associated structures.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
Structural Analysis I lectures, exercises, tutorials:	75 h
Structural Analysis II lectures, exercises, tutorials:	75 h
independent study:	
preparation and follow-up, examination preparation:	150 h
total:	300 h

Content
Calculation of stat. determined and un-determined 2D- and 3D-Beam Structures:

- Idealisations
- load bearing behaviour
- stress resultants
- discrete displacements
- controls
- symmetry
- application of numerical programs
- influence lines, KV, VV
- FEM for 2d truss structures
- prestressing

Outlook: Surface structures, FE-modeling, nonlinearities

Remarks
Literature:

Lecture Notes Baustatik I
Lecture Notes Baustatik II
Krätzig, W.B., Harte, R., Meskouris, K., Wittek, U. (1999): Tragwerke 1 - Theorie und Berechnungsmethoden statisch bestimmter Stabtragwerke, Springer.
Krätzig, W.B., Harte, R., Meskouris, K., Wittek, U. (2005): Tragwerke 2 - Theorie und Berechnungsmethoden statisch unbestimmter Stabtragwerke, Springer.
Wunderlich, W., Kiener, G. (2004): Statik der Stabtragwerke, Teubner.

Module: Basics of Reinforced Concrete [bauiBFP2-KSTR.A]

Coordination: L. Stempniewski
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 5+6

ECTS Credits	Cycle	Duration
6	Every 2nd term, Winter Term	2

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200601	Basics of Reinforced Concrete I	L/E	2/1	W	4	L. Stempniewski
6200615	Basics of Reinforced Concrete II	L/E	2	S	2	L. Stempniewski

Learning Control / Examinations
graded:
partial examination Basics of Reinforced Concrete I, written, 90 min., accord. ER/SPO § 4 par. 2 no. 1
partial examination Basics of Reinforced Concrete II, written, 60 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by weighted average according credit points of grades of the partial examinations

Conditions
Qualifying examinations in the subjects Mechanics, Mathematics, Structural Design, except maximum two modules

Recommendations
It is recommended to attend the following modules previously:
Building Materials [bauiBGP09-BSTOF]
Statics of Structures [bauiBF1-BSTAT]

Qualification Goals
Understanding of the Materials and learning how to design simple components + Getting familiar with the safety concept in structural engineering

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
Basics of Reinforced Concrete I lectures, exercises:	45 h
Basics of Reinforced Concrete II lectures/exercises:	30 h
independent study:	
preparation and follow-up, examination preparation:	105 h
total:	180 h

Content
Characteristics of Reinforced Concrete, Design of Sections and Components, Safety Concept, Design for bending and Transverse forces

Module: Basics in Steel and Timber Structures [bauiBFP3-KSTR.B]

Coordination: H. Blaß, T. Ummenhofer
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 5

ECTS Credits	Cycle	Duration
9	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200504	Basics in Steel Structures	L/E	2/1	W	4,5	T. Ummenhofer
6200507	Timber Structures	L/E	2/1	W	4,5	H. Blaß

Learning Control / Examinations
graded:
examination Basics in Steel and Timber Structures, written, 120 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by grade of examination

Conditions
Qualifying examinations in the core subjects Mechanics, Mathematics, Structural design, except maximum two modules

Recommendations
none

Qualification Goals
Steel structures:
The Students have knowledge in design, construction and assembly of predominantly static loaded steel constructions made of bar-shaped support links. The students are able to construct and design common steel structures.

Timber structures:
The students get to know timber as construction material and the basic characteristics of timber. They get familiar with grading of timber into strength classes. The students are able to design common timber structures according to Eurocode 5. They know the backgrounds of design rules for timber elements and joints. The students get to know different fasteners used in timber structures and the appropriate design theory. They are able to design elements prone to buckling, tapered, curved and pitched cambered beams as wells as bracings.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
Basics in Steel Structures lectures, exercises:	45 h
Timber Structures lectures, exercises:	45h
independent study:	
preparation and follow-up, examination preparation:	180 h
total:	270 h

Content
Steel structures:

- tension bars
- bending stressed bars without compressive forces
- bolted and welded connections
- shear due to shear force - shear center
- flexural buckling
- lateral torsional buckling
- constructional aspects: load transfer, structural types (hall construction, construction with multiple floors), support links (beams, columns, column bases, frame corners)

Timber structures:

- Basics: Timber in construction, wood as building material, solid timber and glued laminated timber – strength classes, limit state design and safety format, volume and stress distribution effects on the strength

- Design of elements: Tension and compression, bending, shear and torsion, columns and buckling lengths, tapered, curved and pitched cambered beams, bracing
- Joints: Mechanical timber joints – general, joints with dowel-type fasteners – theory, nailed joints, bolted and dowelled joints, joints with screws, ring and shear-plate connector joints, toothed-plate connector joints

Remarks
Literature:
lecture notes “Grundlagen des Stahlbaus”, Lehrstuhl für Stahl- und Leichtmetallbau, Universität Karlsruhe (TH)
DIN 18800-1: Stahlbauten - Teil 1: Bemessung und Konstruktion
DIN 18800-2: Stahlbauten - Teil 2: Stabilitätsfälle-Knicken von Stäben
DIN 18800-3: Stahlbauten - Teil 3: Plattenbeulen
DIN 18800-4: Stahlbauten - Teil 4: Schalenbeulen
Blaß, H.J.; Görlacher, R.; Steck, G. (Herausgeber) Holzbauwerke STEP 1 – Bemessung und Baustoffe. Fachverlag Holz, Düsseldorf, 1995 (ISSN-Nr. 04462114)

Module: Water and Environment [bauiBFP4-WASSER]

Coordination: F. Seidel, E. Zehe, S. Fuchs
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 5+6

ECTS Credits	Cycle	Duration
12	Every 2nd term, Winter Term	2

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200509	Hydraulic Engineering and Water Management	L/E	2/1	W	4	F. Nestmann
6200511	Hydrology	L/E	2/1	W	4	E. Zehe
6200603	Water Supply and Sanitation	L/E	2/1	S	4	S. Fuchs

Learning Control / Examinations
graded:
examination Water and Environment, written, 150 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by grade of examination

Conditions
Qualifying examinations in the subjects Mechanics, Mathematics, Structural design, except maximum two modules

Recommendations
It is recommended to attend the module Environmental Physics / Energy previously.

Qualification Goals
The students will get a basic knowledge about the essential meteorological, hydro-meteorological processes of the water cycle on the land surface. They will get knowledge about the hydrological processes and their simplified reproduction in hydrological models so that the students will be capable to calculate rainfall-runoff relations. They will learn to dimension and calculate measures for water management and hydraulic engineering and to quantify the possible failure of such measures. In addition, the knowledge of how the human impact influences hydrological processes will be discussed. They have extensive knowledge about the basic requirements of water management tasks. They know the operation conditions, the functions and the technical design of water management systems.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
Hydraulic Engineering and Water Management lectures, exercises:	45 h
Hydrology lectures, exercises:	45 h
Water Supply and Sanitation lectures, exercises:	45 h
independent study:	
preparation and follow-up, examination preparation:	225 h
total:	360 h

Content
Hydraulic Engineering and Water Ressources Management:

- basics and applications of open channel hydraulics
- Aims of water management in europe and germany
- classification of tasks in the field of water management
- floot protection: concepts, measures and models
- Constructions for discharge controlling: function and hydraulic dimensioning
- river engineering: navigation and restauration

Hydrology:

- introduction to the cycles of energy, water and air
- hydrological processes in a catchment and water balances
- measurement, evaluation and statistical interpretation of hydrological data

- introduction to runoff generation and concentration, including relevant model concepts
- methods for regionalising hydrological parameters and model parameters
- evaluation of flooding with the help of rainfall-runoff models
- planning, dimensioning and operation of flood preventien measures
- dimensioning the working capacity for dams
- security concepts for dams and embankments after DIN 19700
- impact of changing border conditions (e.g. landuse-change, climate change) on the runoff of catchments

Sanitary Environmental Engineering:

- tasks of sanitary environmental engineering
- basics
- processes in sanitary environmental engineering
- water supply
- urban drainage
- storm water treatment
- waste water treatment

Module: Mobility and Infrastructure [bauiBFP5-MOBIN]

Coordination: R. Roos
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 4

ECTS Credits	Cycle	Duration
12	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200404	Spatial Planning and Planning Law	L/E	2/1	S	4	S. Wilske
6200405	Transportation	L/E	2/1	S	4	P. Vortisch
6200407	Design Basics in Highway Engineering	L/E	2/1	S	4	R. Roos

Learning Control / Examinations
graded:
examination Mobiliy and Infrastructure, written, 150 min., accord. ER/SPO § 4 par. 2 no. 1
attested, as prerequisite for examination:
attestation of both term papers in Transportation and Design Basics in Highway Engineering, accord. ER/SPO § 4 par. 2 no. 3
grading:
grade of module is defined by grade of examination

Conditions
none

Recommendations
none

Qualification Goals
The graduates know the basic methods and procedures to deal with general problems in spatial planning, transport studies and highway engineering. They are able to examine fundamental calculations related to the mentioned subjects and to use the required tools in a methodically appropriate way. Further, they can argue specialized, find, develop and evaluate solutions.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
Spatial Planning and Planning Law lectures, exercises:	45 h
Transportation lectures, exercises:	45 h
Design Basics in Highway Engineering lectures, exercises:	45 h
independent study:	
preparation and follow-up:	60 h
preparation of student research papers:	80 h
examination preparation:	80 h
total:	355 h

Content
The module is divided into 3 parts:
The part Spatial Planning and Planning Law involves basic tasks and problems on different planning levels such as land use and conflicts, provision of services and infrastructure as well as their costs, planning on local, regional, national and European level.
The fundamentals of transportation planning (convention for analyses, surveys of travel behaviour) and traffic engineering are covered by the part Transport Studies.
The part Design Basics in Highway Engineering involves road network layout, principles of highway design, driving dynamics, earthworks as well as pavements and their dimensioning.

Module: Technology and Management in Construction Operation [bauiBFP6-TMB]

Coordination: S. Haghsheno
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 4

ECTS Credits	Cycle	Duration
11	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200409	Construction Technology	L/E	3/1	S	5,5	S. Haghsheno, S. Gentes
6200411	Economics in Construction Operation	L/E	2/1	S	4	K. Lennerts
6200513	Facility- and Real Estate Management	L	1	S	1,5	K. Lennerts

Learning Control / Examinations
graded:
examination Technology and Management in Construction Operation, written, 150 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by grade of examination

Conditions
none

Recommendations
none

Qualification Goals
After completion of the module Technology and Management in Construction Operation the students are able to work on common technical and economic problems in construction operation.
During the lecture Construction Technology the students obtain the ability to compare different construction technologies. They can list different machinaries and methods and compare and evaluate their advantages and disadvantages. They are able to run basic production calculations in different fields of construction management with respect to their later professional life. They can apply common design tools for this purpose. Furthermore, they understand different theoretical topics of different fields in construction management and can these explain and interlink with each other.
In the economic field, students can perform calculations of internal and external accounting. You can perform simple bookings for creating a balance sheet, select investment alternatives using appropriate methods of investment appraisal and are able to discuss the processes involved in the calculation of building projects. Furthermore, students can explain the pros and cons of different topics of the construction sector. On selected topics in the construction contract law, students can take a position.
In the area of facility and real estate management, they can describe the specifics of tenancy and perform a service charge settlement. Furthermore, they understand the growing importance of sustainability in real estate management.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
Construction Technology lectures, exercises:	60 h
Economics in Construction Operation lectures, exercises:	45 h
Facility- and Real Estate Management lectures:	15 h
independent study:	
preparation and follow-up, examination preparation:	210 h
total:	330 h

Content
The module consists of three lectures in which following will be discussed
Construction technology:
In construction technology the primary basics of machine technology and execution of construction work and also the project phases prior to construction start are presented. For this purpose, topics such as tendering, placing, ordering, process planning and logistics are described in more detail. Furthermore, the lecture addresses the practises carried out at a construction site. Topics such as preparation technologies, concrete construction, earthworks, special underground engineering and bridge construction are covered.
Building Economics:

In this lecture series the basics of Construction Economics are taught. The legal forms of companies, the organisation forms, the basics of personal management and the basics of accounting are presented. Furthermore, the developed investment accounting, calculation methods and financing options. It will provide an overview of the law of contract HOAI and VOB. Finally, methods of personnel management and modern Pricing are presented.
Lecture facility and real estate management:
In the introductory lecture to the facility and real estate management first fundamental issues are worked out. In addition to the general basics are this tenancy law and the by cost management for residential and commercial properties. The importance of sustainable development in the facility and real estate management is further elaborated.

Module: Geotechnical Engineering [bauiBFP7-GEOING]

Coordination: T. Triantafyllidis
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 4+5

ECTS Credits	Cycle	Duration
9	Every 2nd term, Summer Term	2

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200412	Basics in Soil Mechanics	L/E/T	2/2/2	S	4,5	T. Triantafyllidis
6200514	Basics in Foundation Engineering	L/E/T	2/1/2	W	4,5	T. Triantafyllidis

Learning Control / Examinations
graded:
examination Geotechnical Engineering, written, 150 min., accord. ER/SPO § 4 par. 2 no. 1
grading:
grade of module is defined by grade of examination

Conditions
Qaulifying examinations in Mechanics, Mathematics, Structural Design, except maximum two modules

Recommendations
It is recommended to have passed the module Geology in Civil Engineering [bauiBGP13-GEOL] previously.

Qualification Goals
The students have a scientifically sound understanding of the building material “soil” with respect to its appearance and mechanical behaviour. They are able to describe the latter on base of soil mechanical and soil hydraulic models, to classify and to analyse respective field and laboratory tests.
Because of their knowledge in usual geotechnical construction methods they can self-dependently select, design and describe the construction process for standard applications, such as building foundations, construction pit linings and tunnels adapted to the respective ground and groundwater conditions. Further, they are able to proof self-dependently ultimate limit states and serviceability limit states of those geotechnical constructions and natural slopes and to evaluate the results critically.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
Basics in Soil Mechanics lectures, exercises, tutorials:	90 h
Basics in Foundation Engineering lectures, exercises, tutorials:	75 h
independent study:	
preparation and follow-up	20 h
examination preparation:	100 h
total:	285 h

Content
„Basics in Soil Mechanics“ imparts students predominantly the theoretical basics of soil behaviour:

- Standards and codes, definitions, soil classification
- soil properties and soil parameters, subsoil investigation
- permeability and seepage
- compression behaviour, stress distributions
- settlement calculation, consolidation
- shear resistance of soils
- earth pressure and earth resistance
- stability of slopes (slope failure) and foundations (base failure)

„Basics in Foundation Engineering“ refers to the above contents and applies them in practise to the following geotechnical methods and constructions:

- safety concepts in foundation engineering

- dewatering
- spread foundations
- retaining structures
- retaining walls for excavations
- pile foundations, deep foundations and caisson foundations in open water
- soil improvement
- tunneling

Remarks
Both lectures build up one thematic unit. Therfore, partial examinations are not possible.
Tutorials associated with the lecture „Basics in Soil Mechanics“ (6200418) are offered. Its attendance is recommended.
Literatur:
Triantafyllidis, Th. (2014): Arbeitsblätter und Übungsblätter Bodenmechanik
Triantafyllidis, Th. (2011): Arbeitsblätter und Übungsblätter Grundbau
Gudehus, G (1981): Bodenmechanik, F. Enke
Grundwissen „Der Ingenieurbau“ (1995) Bd. 2: Hydrotechnik – Geotechnik, Ernst u. Sohn

4.4 Module Bachelor Thesis

Module: Bachelor Thesis [bauiBSC-THESIS]

Coordination: Studiendekan Bauingenieurwesen
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory semester 6

ECTS Credits	Cycle	Duration
11	Every term	1

Learning Control / Examinations
Thesis with a duration of 3 months and final presentation, accord. ER/SPO § 11
grading:
The mark results from the grading of the Bachelor Thesis and the concluding presentation.

Conditions
attestation of acknowledged practical work accord. ER/SPO § 12,
passed examinations in all modules of Basic Studies accord. ER/SPO § 17 par. 2

Recommendations
none

Qualification Goals
The student is able to investigate a complex problem within a particular field of his choice in limited time, following scientific methods. He can search autonomously for literature, can find own approaches, can evaluate his results and can compare them with the state of the art. He is further able to represent clearly the essential matter and results in his bachelor thesis.

Workload
approx. 2 months net within a period of 3 months

Content
The Bachelor Thesis is a first major written report and comprises the theoretical or experimental treatise of a complex problem within a particular field of civil engineering with scientific methods. The student chooses a particular field and can make proposals for the theme.

Remarks
The Bachelor Thesis can be allocated and supervised by professors, habilitated or academic members of the faculty, those got the permission to conduct examinations (comp. ER/SPO § 15 Par. 2).

4.5 Compulsory Elective Modules Basic Subject Studies

Module: Partial Differential Equations [bauiBFW1-PDGL]

Coordination: M. Hochbruck, V. Grimm, M. Neher
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 4

ECTS Credits	Cycle	Duration
2	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
0181600	Partial Differential Equations	L/E	1/1	S	2	M. Hochbruck, V. Grimm, M. Neher

Learning Control / Examinations
attested:
attestation Partial Differential Equations, written, 60 min., accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
It is recommended to attend the module Differential Equations [bauiBGP08-HM3] previously.

Qualification Goals
The students

- obtain fundamental knowledge of vector calculus and numerical methods for partial differential equations,
- master the mathematical concepts required in qualitative and quantitative modelling in engineering,
- become able to apply the covered methods for mathematical modelling of engineering problems self-reliantly and with confidence and to solve the resulting mathematical problem with the selected tools

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises:	30 h
independent study:	
preparation and follow-up, attestation preparation:	30 h
total:	60 h

Content

- vector fields
- line and surface integrals of vector fields
- divergence theorem, Green's theorem, Stokes' theorem
- finite difference methods for parabolic equations
- numerical treatment of hyperbolic problems
- finite element method

Module: Introduction to Continuum Mechanics [bauiBFW2-EKM]

Coordination: T. Seelig
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 6

ECTS Credits	Cycle	Duration
2	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200607	Introduction to Continuum Mechanics	L	2	S	2	T. Seelig, P. Betsch

Learning Control / Examinations
attested:
attestation Introduction to Continuum Mechanics, written, 60 min., accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
It is recommended to have passed the following subjects and modules previously:
Mechanics, Mathematics, Partial Differential Equations [bauiBFW1-PDGL]

Qualification Goals
Fundamentals for the analysis of multiaxial loading states and deformation in elastic solids are presented.
This includes the formulation of engineering problems in terms of boundary value problems as well as the interpretation of solutions, e.g. with respect to stress concentrations.
Besides analytical solution techniques in 2D (plane) problems, special emphasis is put on variational (energy) methods which form the basis of numerical methods such as the finite element method.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures:	30 h
independent study:	
preparation and follow-up, attestation preparation:	30 h
total:	60 h

Content

- vectors, tensors, index notation
- stress and equilibrium
- displacement and strain
- linear elastic material law
- boundary value problems of elasticity theory
- plane problems
- Airy's stress function
- local stress concentrations
- work and energy principles of elasticity theory
- approximate solution methods

Remarks
Literature:
Doghri, I. (2000): Mechanics of Deformable Solids. Springer
Fung, Y.C. (1965): Foundations of Solid Mechanics. Prentice Hall
Gross, D., Hauger, W., Wriggers, P. (2007): Technische Mechanik IV, Springer
Gould, P.L. (1983): Introduction to Linear Elasticity. Springer

Szabo, I. (2001): Höhere Technische Mechanik. Springer
Vielsack, P.: Einführung in die Kontinuumsmechanik, lecture notes (only by parts)

Module: Physical Modelling in River Engineering [bauiBFW3-WASSVW]

Coordination: F. Seidel
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 6

ECTS Credits	Cycle	Duration
2	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200609	Physical Modelling in River Engineering	L	2	S	2	F. Seidel, C. Lang

Learning Control / Examinations
attested:
attestation Physical Modelling in River Engineering, attested experiment reports, accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
It is recommended to attend the following modules and lectures previously:
Hydromechanics [bauiBGP04-HYDRO]
Hydraulic Engineering and Ressources Management (6200509)

Qualification Goals
The students have the competence, the apply the possibilities and limitations of hydraulic tests on situational water problems. They can design, construct an operation a hydraulic model and they can evaluate the develloped results/solutions.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises:	30 h
independent study:	
preparation and follow-up, laboratory report:	30 h
total:	60 h

Content
The course gives an detailled overview about the application of hydraulic models for the optimzation of hjydrodynamic processes.
Content:

- Definition of a hydraulic model
- affinity between hydraulic model an nature
- provisions of working with hydraulic models
- planning and construction of a hydraulic model
- hydrometric methods
- Exercize in the laboratory
- Exemples from the practice
- excursion to the waterlabs in Karlsruhe

Remarks
Materials:
lecture notes
slides and additional study material at website of IWG

Module: Geotechnical Design [bauiBFW4-GEOPL]

Coordination: T. Triantafyllidis
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 6

ECTS Credits	Cycle	Duration
2	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200611	Geotechnical Design	L	2	S	2	T. Wichtmann

Learning Control / Examinations
attested:
attestation Geotechnical Design, term paper with passed colloquium, accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
It is recommended to attend the module Geotechnical Engineering [bauiBFP7-GEOING] previously.

Qualification Goals
The students are able to subdivide complex problems into single construction steps and standard design problems. They can give reasons, which geotechnical proofs and calculations are required respectively, and they practised to conduct these self-dependently by application of the relevant standards and eventually by use of getechnical software tools. Thereby, they can trade off different options against each other under consideration of aspects of site management and budgeting and they can optimize solutions.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures:	30 h
independent study:	
preparation of term paper, attestation preparation:	30 h
total:	60 h

Content
Specialized exercises based on contents of the module „Geotechnical Engineering“ by means of a project study:

- soil investigation, classification and material properties,
- consolidation under ballast loads,
- settlement analysis of structures,
- shear strength,
- slope stability analysis,
- anchored sheetpile retaining wall,
- dewatering of construction pits,
- spread foundations under multiaxial load,
- design of pile foundations

Remarks
Literature:
Triantafyllidis, Th. (2014): Arbeitsblätter und Übungsblätter Bodenmechanik
Triantafyllidis, Th. (2011): Arbeitsblätter und Übungsblätter Grundbau
Gudehus, G (1981): Bodenmechanik, F. Enke
Grundwissen „Der Ingenieurbau“ (1995) Bd. 2: Hydrotechnik – Geotechnik, Ernst u. Sohn

Module: Surveying [bauiBFW5-VERMK]

Coordination: N. Rösch
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 6

ECTS Credits	Cycle	Duration
2	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
20714	Surveying	L/E	1/1	S	2	N. Rösch

Learning Control / Examinations
attested:
attestationSurveying, attested surveying exercise, accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
none

Qualification Goals
It is the main objective of this course to make the students familiar with surveying. Thus the application of typical surveying instruments is presented. Further the basic methods and procedures are explained.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures, exercises:	30 h
independent study:	
preparation and follow-up, preparation surveying report:	30 h
total:	60 h

Content
The following items are covered:

- The surveying authorities in Germany
- Reference frames (local and international)
- Coordinate systems (e.g. UTM, Gauß-Krüger)
- Height determination
- 2D point determination
- Basic surveying computations (e. g. polar method, intersection, resection)
- Computation of areas based on different readings
- Computation of volumes

Module: Project “Plan, Design, Engineering” [bauiBFW6-PPEK]

Coordination: R. Roos
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 6

ECTS Credits	Cycle	Duration
2	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200516	Project “Plan, Design, Engineering”	Pj	2	S	2	R. Roos, P. Vortisch, B. Brester, E. Hohnecker

Learning Control / Examinations
attested:
attestation Project “Plan, Design, Engineering”, group exercise with intermediate and final presentation, accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
It is recommended to attend the module Planning Methodology [bauiBGP11-PLANM] previously.

Qualification Goals
The graduates are able to understand the planning requirements of the different subjects in the fields of mobility and infrastructure and to discuss them with respect to a specific example. By technical guidance, they find realizable solutions and understand roughly the planning-related multidisciplinary processes in weighting. Furthermore, they are able to work self-organized and to have available organizational and didactical competences with respect to team work and presentations.

Workload

contact hours:	
on-site meeting, project and technical group meetings, präsentations:	16.5 h
independent study:	
preparation and follow-up:	5.5 h
team exercise (per person):	35.0 h
total:	57 h

Content
A typical practical task in the field of spatial and infarastructure planning has to be elaborated (e.g. ideas contest in town planning). The students have to take charge of certain planning tasks from the fields town planning, transport studies, highway engineering and track guided transport systems with the technical background provided by mentors. During this gaming simulation solutions will be elaborated and presented in different levels of detail.

Module: Life Cycle Management [bauiBFW7-LZMAN]

Coordination: K. Lennerts, H. Müller
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 6

ECTS Credits	Cycle	Duration
2	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200613	Life Cycle Management	L/E	2	S	2	K. Lennerts, H. Müller, E. Kotan, M. Vogel

Learning Control / Examinations
attested:
attestation Life Cycle Management, written, 60 min., accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
It is recommended to attend the following modules previously:
Building Materials [bauiBGP07-STATS]
Applied Statistics [bauiBGP09-BSTOF]
Technology and Management in Construction Operation [bauiBFP6-TMB]

Qualification Goals
After this module the students have basic knowledge about the subject of life cycle management (LCM).
They know the characteristics of the life cycle of buildings as well as their influence on the environment. The students are able to explain the life cycle phases of buildings and their specific characteristics. They are able to describe the influencing parameters with impact on the life time of construction elements. They know suitable calculation methods as well as the required input parameters and are able to conduct simple calculations of life cycle costs.
The students have knowledge about the methods of durability design of concrete structures as well as about the maintenance (service, inspection, repair and improvement) of constructions.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures/exercises:	30 h
independent study:	
preparation and follow-up, attestation preparation:	30 h
total:	60 h

Content
This module contains an introduction to the concepts of life cycle management. Particularly the different methods of calculation and optimisating of life cycle costs are presented.
A further main part of the module is an introduction to the methods of registration and modelling of damages in order to assess the degree of damage and to perform a service life prediction of concrete structures in a proper manner.
The assessment of the durability of concrete structures is managed with the help of reliability considerations. Therefore, it is necessary to get a basic overview of the reliability theory. Then, it is possible to arrange a service life design of structures, which are under environmental stress (frost attack, salt, carbon dioxide).
Furthermore, this course also contains an introduction to the methods of maintenance planning and maintenance realisation of concrete structures which are damaged by different environmental attacks.

Remarks
Literatur:
lecture notes / respective literature is presented within the lecture

Module: Basics of Track Guided Transport Systems [bauiBFW8-GSTS]

Coordination: E. Hohnecker
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 5

ECTS Credits	Cycle	Duration
2	Every 2nd term, Winter Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200517	Basics of Track Guided Transport Systems	L	2	W	2	E. Hohnecker

Learning Control / Examinations
attested:
attestation Basics of Track Guided Transport Systems, written, 60 min., accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
none

Qualification Goals
to know the basics of track guided systems

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures:	30 h
independent study:	
preparation and follow-up, attestation preparation:	30 h
total:	60 h

Content
following topics are addressed in this lecture:

- definitions and classifications
- basics of rail vehicles
- track guided operation
- railway alignment

Remarks
Literature:
Zilch, Diederichs, Katzenbach, Beckmann (Hrsg): Handbuch für Bauingenieure, Springer-Verlag 2012

Module: Water Resources Management and Engineering Hydrology [bauiBFW9-WASSRM]

Coordination: J. Ihringer
Degree programme: Bauingenieurwesen SPO 2013 (B.Sc.)
Subject: compulsory elective semester 6

ECTS Credits	Cycle	Duration
2	Every 2nd term, Summer Term	1

Courses in module

ID	Course	Course type	Hours per week	Term	CP	Responsible Lecturer(s)
6200617	Water Resources Management and Engineering Hydrology	L/E	2	S	2	J. Ihringer

Learning Control / Examinations
attested:
attestation Water Resources Management and Engineering Hydrology, written, accord. ER/SPO § 4 par. 2 no. 3
grading:
n. a.

Conditions
none

Recommendations
It is recommended to attend the following modules and lectures previously:
Environmental Physics / Energy [bauiBGW3-UPHYS]
Hydrology (6200511), content is supposed as known !

Qualification Goals
The students know the relevant basics of hydrologic models. They are able to apply these models to design facilities and measures in the field of water management and hydraulic engineering. They know the limits of application and the existing uncertainties. They are familiar with the relevant regulations to be considered and respected especially for the safety-relevant proofs of dams.

Workload

contact hours (1 HpW = 1 h x 15 weeks):	
lectures/exercises:	30 h
independent study:	
preparation and follow-up, attestation preparation:	30 h
total:	60 h

Content

- basics of hydrologic modeling
- regionalization of relevant hydrologic parameters
- determination of design parameters for facilities and measures in the field of water management and hydraulic engineering by hydrologic modelling
- design of
- Bemessung von flood retention basins
- spatially resolved hydrologic modelling using a river basin model
- introduction to the software tool „Hochwasseranalyse und –berechnung“

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