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Module Descriptions - Modules of the Degree Course Bachelor of Chemistry

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Chemie-BK01	**General Chemistry**
module description	**General Chemistry**
module code	**Chemie-BK01**
faculty / subject / department	faculty 08 / all chemistry departments
applies to degree courses / semesters	BSc chemistry, BSc materials science, BSc food chemistry 1st semester
module coordinator	Cf. German version
advice on the module	* please see separate list for the current semester
prerequisites	none
course aims	Students should have knowledge of… the fundamental parameters of physical chemistry, such as forms of material states and bonds as well as the principles of thermodynamics, chemical equilibrium and electrochemistry the periodic table and the relationships within the table, valence notation and chemical bonding models, the law of mass action, acid-base theories, redox reactions and simple inorganic-chemical compounds including their properties the organic-chemical nomenclature, forms of isomers, organic-chemical groups of substances and their features, the most important natural products chemical phenomena of daily life
content of module	**PC** Structure of matter, aggregate states, separation of substances; concept of elements; atom structure, isotopes, electron configuration; periodic table of elements; definition of the mol; ideal gas law; energy and entropy; thermodynamic principles; principles of kinetics; chemical bonds (metallic bonds, ion bonds, covalent bonds) **AC** Valency bond formulas and mesomerism; chemistry of main groups, characteristics of important compounds; simple chemical calculations; law of mass action; solubility products; investigation of acids and bases, pH, pKa value, buffer solutions; redox reactions, electrochemistry, electrolysis, galvanic element, Nernst equation **OC** Hybridization, bonding in organic compounds; alkanes, alkenes, alkynes, aromatic hydrocarbons, isomerism, simple nomenclature, redox reactions, optical activity, CIP nomenclature, concept of functional groups, important organic groups of substances
forms of instruction	lecture practical exercises
workload in total	lecture attendance hours 60 h preparation, follow-up 60 h practical exercises attendance hours 1 12 h preparation, follow-up 24 h examination examination incl. preparation 24 h Σ 180 h
examination admission requirement	none
module examination	written examination (2 h)
module grading	written examination (100 %)
form of exam resit	written examination
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester

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language	German
intake capacity of course	250
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK02	**General Chemistry Laboratory Course**
module description	**Practical Introduction to General Chemistry**
module code	**Chemie-BK02**
faculty / subject / department	faculty 08 / all chemistry departments
applies to degree courses / semesters	BSc chemistry, BSc materials science, BSc food chemistry 1st semester
module coordinator	Cf. German version
prerequisites	none
course aims	Students should… be proficient in fundamental practical laboratory procedures in compliance with good laboratory practice be able to document their lab results in lab journals and protocols master the basic methods of qualitative and quantitative analysis of substances master the basic separation techniques be able to plan, set up, conduct and evaluate simple chemical and physical-chemical experiments
content of module	"laboratory certificate" (safe working in the laboratory) acids and bases, pH, chemical equilibrium, titration redox reactions, galvanic element, redox potentials equilibrium constants, solubility products complex formation filtration, crystallization, distillation, chromatography inorganic and organic chemical tests organic-chemical laboratory techniques (distilling, stirring, recrystallization, etc. simple organic-chemical experiments basic experiments on energetics of chemical reactions (exothermic, endothermic, exergonic, endergonic), on chemical equilibrium, on electrochemistry
forms of instruction	laboratory course seminar
workload in total	laboratory course attendance hours 56 h preparation, follow-up 56 h seminar attendance hours 1 34 h preparation, follow-up 34 h Σ 180 h
examination admission requirement	regular attendance of seminar and practical course
module examination	protocols (100%)
module grading	no grades; module is passed when all protocols have been accepted
form of exam resit	
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	250
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable
Chemie-BK03	**Experimental Physics I**
module description	**Experimental Physics I – Mechanics and Thermodynamics**

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module code	**Chemie-BK03**
faculty / subject / department	faculty 07 / physics
applies to degree courses / semesters	BSc chemistry, L2 physics 1st semester
module coordinator	Cf. German version
prerequisites	none
course aims	Students should … have knowledge of the fundamental phenomena and principles in the fields of mechanics and thermodynamics have knowledge of the fundamentals and conservations laws be able to describe the phenomena mathematically and find solutions to simple problems be able to acquire the foundations for conducting simple experiments from literature have knowledge on basic measuring equipment be able to represent experimental results
content of module	base quantities, kinematics, Newton's laws of motion, fundamental interactions, pseudo forces, impulse, work and energy, angular momentum, statics and dynamics of rigid bodies, relativistic mechanics, mechanics of deformable media, mechanical oscillation and waves, acoustics kinetic gas theory, laws of thermodynamics, real gases and phase transitions, forms of thermal conductivity physical measuring methods
forms of instruction	lecture (4 h/week) practical exercises (2 h/week) laboratory course (5 experiments, 1 h/week)
workload in total	lecture attendance hours 60 h preparation, follow-up 30 h practical exercises attendance hours 30 h preparation, follow-up 30 h laboratory course attendance hours 15 h preparation, follow-up 25 h examination examination incl. preparation 20 h Σ 210 h
examination admission requirement	written examination on lectures: none final colloquium on lab course: all protocols accepted
module examination	written examination (2 h)
module grading	written examination on lectures(75 %) written examination or final colloquium on lab course (25 %)
form of exam resit	written examination or final colloquium
credit points	7 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable
Chemie-BK04	**Mathematics**
module description	**Mathematics**
module code	**Chemie-BK04**

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faculty / subject / department	faculty 07 / physics, FB 08 / chemistry
applies to degree courses / semesters	BSc materials science, BSc chemistry, BSc food chemistry, L3 chemistry 1st semester
module coordinator	Cf. German version
prerequisites	none
course aims	Students should have the ability to apply mathematical methods and describe physical processes in the following fields: vector calculus matrix calculus differential and integral calculus in one and several variables differential equations
content of module	Analysis: numbers, sequences, series, functions (polynomials, e. In, sin, cos, tan, cos, arcus), complex numbers, continuous function, differential and integral calculus in one dimension, Taylor series, solving simple linear and inhomogeneous differential equations; differential calculus in several variables (total differential); integral calculus in several variables: line integral, partial differential equation using wave equation Linear algebra: vectors, matrices, solving linear equation systems, determinants, eigenvalues, eigenvectors
forms of instruction	lecture (4 h/week) practical exercises (2 h/week)
workload in total	lecture attendance hours 60 h preparation, follow-up 20 h practical exercises attendance hours 30 h preparation, follow-up 50 h unsupervised work 20 h examination examination incl. preparation 30 h Σ 210 h
examination admission requirement	successful completion of 50 % of practical exercises
module examination	2 written examinations (á 2 h)
module grading	average of both exams: 100 %
form of exam resit	written examination
credit points	7 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK05	**Introduction to EDP**
module description	**Introduction to EDP**
module code	**Chemie-B05**
faculty / subject / department	faculty 07 / physics, faculty 08 / chemistry
applies to degree courses / semesters	BSc chemistry, BSC food chemistry 1st semester
module coordinator	Cf. German version
prerequisites	none
course aims	Students should recognise the wide range of applications for a computer as an instrument for data collection, calculation, analysis, visualisation and data communication within networks be able to perform basic tasks in these central areas independently
content of module	word processing and presentation programmes (Word, PowerPoint) computer calculation (e.g. Excel, Maple, Mathematica) data analysis and visualisation (e.g. Origin/Excel) data communication and research (internet) electronic literature research and procurement
forms of instruction	lecture (0.3 h/week) practical exercises (1.3 h/week)
workload in total	lecture attendance hours 5 h preparation, follow-up 5 h practical exercises attendance hours 1 20 h preparation, follow-up 30 h Σ 60 h
examination admission requirement	none
module examination	practical exercises
module grading	practical exercises: 100 %
form of exam resit	practical exercises
credit points	2 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK-06	**Inorganic Chemistry 1**
module description	**Inorganic Chemistry 1 – Chemistry of Sub-Groups**
module code	**Chemie-BK-06**
faculty / subject / department	faculty 08 / chemistry / inorganic chemistry
applies to degree courses / semesters	BSc chemistry, BSc materials science 2nd semester
module coordinator	Cf. German version
prerequisites	General Chemistry
course aims	Students should have a grasp of the principles of the chemistry of substances governing sub-group elements and recognise reactivity and structure trends become familiar with bonding concepts of coordination chemistry and evaluate these in comparison to other bonding models
content of module	creating sub-group metals and the chemistry of their substances, trends in reactivity and structure of sub-group element compounds, concepts of coordination chemistry (nomenclature, ligand field, ligand exchange), key large-scale basic processes (furnace, copper refining, titanium oxide, obtaining noble metals)
forms of instruction	lecture (15 weeks á 3 h) practical exercises (15 weeks á 1 h)
workload in total	lecture attendance hours 45 h preparation, follow-up 15 h practical exercises attendance hours 15 h preparation, follow-up 10 h unsupervised work 20 h examination examination incl. preparation 15 h Σ 120 h
examination admission requirement	active participation in practical exercises
module examination	written examination (2 h)
module grading	written examination (100 %)
form of exam resit	written examination (2 h)
credit points	4 CP
frequency, duration in semesters	summer semester, 1 semester
language	German
intake capacity of course	90
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK07	**Physical Chemistry 1**
module description	**Physical Chemistry 1 – Thermodynamics and Electrochemistry**
module code	**Chemie-BK07**
faculty / subject / depart.	faculty 08 / chemistry / physical chemistry
applies to degree courses / semesters	BSc chemistry, BSc materials science, BSc food chemistry 2nd semester
module coordinator	Cf. German version
prerequisites	General Chemistry or Mathematics
course aims	Students should have a command of the fundamental laws of chemical thermodynamics, electrochemistry and chemical kinetics have knowledge of the physical-chemical approaches in these fields and be able to apply these to other fields of chemistry
content of module	1. Introduction to Thermodynamics: ideal and real gases, thermal and caloric equation of state, 1st law, thermochemistry, Carnot cycle, entropy, Joule-Thomson effect, partial molar quantities, fundamental equations of thermodynamics, chemical potential, chemical equilibrium, phase equilibrium, mixed phase thermodynamics (phase diagrams) 2. Electrochemistry: principle concepts, ion migration, weak and strong electrolytes, solid electrolytes, reversible cell voltage (EMF), electric dipole, electrochemical potential, electrode potential, half cells, half cell voltage, Stockholm convention, diffusion potential, different types of galvanic cells: chemical cells, concentration cell (e.g. λ sensor) 3. Fundamentals of Chemical Kinetics: Arrhenius equation, formal kinetics, reactions of nth order, dynamic equilibrium, chain reactions and quasi stationarity
forms of instruction	lecture practical exercises
workload in total	lecture attendance hours 60 h preparation, follow-up 20 h practical exercises attendance hours 1 30 h preparation, follow-up 50 h unsupervised work 20 h examination examination incl. preparation 30 h Σ 210 h
examination admission requirement	successful completion of 50 % of exercises
module examination	written examination (120 min)
module grading	written examination (100 %)
form of exam resit	written examination (120 min)
credit points	7 CP
frequency, duration in semesters	summer semester, 1 semester
language	German
intake capacity of course	90
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK08	**Organic Chemistry I**
module description	**Organic Chemistry 1 (Organic Chemistry of Substances)**
module code	**Chemie-BK08**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc chemistry, BSc materials science 2nd semester
module coordinator	Cf. German version
prerequisites	pass in General Chemistry
course aims	Students should recognise functional groups and be able to assess their basic reactivity be familiar with the fundamental structures and characteristics of organic-chemical groups of substances including their nomenclature comprehend the bonding properties in CX simple and multiple bonds recognise and have a good command of all forms of isometry in organic molecules, particularly stereo isomers have knowledge of fundamental organic reaction mechanisms be able to write down and explain fundamental reaction mechanisms
content of module	alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, amines, carbonyl compounds and their basic reactions including fundamental mechanisms simple molecular orbital theory, conformation analysis principle of potential surface, reactivity-selectivity principle, thermodynamic and kinetic control simple heterocyclic compounds radical reactions, chain reactions S_N reactions stereo chemistry additions and eliminations conjugation and hyperconjugation, resonance, aromaticity substitution reactions in aromatic hydrocarbons pericyclic reactions fundamental carbonyl chemistry natural product groups
forms of instruction	lecture practical exercises
workload in total	lecture attendance hours 45 h preparation, follow-up 45 h practical exercises attendance hours 1 7 h preparation, follow-up 14 h examination incl. preparation 9 h Σ 120 h
examination admission requirement	successful completion of 50 % of exercises
module examination	written examination (2 h)
module grading	written examination (100 %)
form of exam resit	written or oral examination
credit points	4 CP
frequency, duration in semesters	summer semester, 1 semester
language	German or English (as required); Literature: English
intake capacity of course	150

remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK09	**Experimental Physics II**
module description	**Experimental Physics II – Electricity and Optics**
module code	**Chemie-BK09**
faculty / subject / department	faculty 07 / physics
applies to degree courses / semesters	BSC chemistry, L2 physics 2nd semester
module coordinator	Cf. German version
prerequisites	none
course aims	Students should possess knowledge of the fundamental phenomena and principles of physics in the fields of electricity and optics have a command of basic physical concepts and laws of conservation
content of module	electrostatics, electric current, magnetostatics, induction applications of electromagnetism, electrical and magnetic properties of matter, Maxwell's equations, electric vibrations and waves, light as electromagnetic wave geometric optics, physical optics, fundamentals of quantum and wave mechanics; simple examples physical metrology
forms of instruction	lecture (4 h/week) practical exercises (2 h/week) laboratory course (5 experiments, 1 h/week)
workload in total	lecture attendance hours 60 h preparation, follow-up 30 h practical exercises attendance hours 30 h preparation, follow-up 30 h laboratory course attendance hours 15 h preparation, follow-up 25 h examination examination incl. preparation 20 h Σ 210 h
examination admission requirement	written examination on lecture: none final colloquium on lab course: all protocols accepted
module examination	written examination on lecture (2 h) written examination or final colloquium on lab course (30 min)
module grading	written examination on lecture (75 %) written examination or final colloquium on lab course (25 %)
form of exam resit	written examination or final colloquium
credit points	7 CP
frequency, duration in semesters	summer semester, 1 semester
language	German
intake capacity of course	
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK10	**Inorganic-Chemistry Laboratory Course 1**
module description	**Inorganic Chemistry Laboratory Course 1**
module code	**Chemie-BK10**
faculty / subject / department	faculty 08 / chemistry / inorganic and analytic chemistry
applies to degree courses / semesters	BSc chemistry 2nd semester
module coordinator	Cf. German version
prerequisites	Laboratory Course on General Chemistry, Inorganic Chemistry 1
course aims	Students should become familiar with basic preparation methods of inorganic chemistry outline basic types of inorganic compounds acquire practical experience of the chemistry of substances of chemicals used gain experience of characterisation of the prepared substances acquire basic skills in evaluation of experiments and drawing up protocols learn the various safety aspects in chemical laboratories
content of module	1. Experiments on preparation methods: wet chemistry (dissolution, solubilization, precipitation), reactions with gases, oxidization and reduction, molten mass electrolysis, solid state reactions, melting down sensitive compounds 2. Experiments on basic types of inorganic compounds: element oxides, halides, nitrides and sulfides; zeolites, gases, main group molecules, coordination complexes, organometallic compounds 3. Characterisation methods: IR/Raman, NMR, LFS
forms of instruction	laboratory course (18 days á 7 h) practical exercises (18 x 1 h; parallel to lab course) seminar (15 x 1 h)
workload in total	seminar attendance hours 15 h preparation, follow-up 30 h practical exercises attendance hours 18 h preparation, follow-up 36 h laboratory course attendance hours 126 h preparation, follow-up 75 h Σ 300 h
examination admission requirement	regular attendance of seminar and lab course, active participation in practical exercises
module examination	protocols
module grading	No grades; module is passed on acceptance of all protocols
form of exam resit	protocols
credit points	10 CP
frequency, duration in semesters	summer semester, 1 semester
language	German
intake capacity of course	60
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK11	**Inorganic Chemistry 2**
module description	**Inorganic Chemistry 2 – Chemistry of Main Groups**
module code	**Chemie-BK11**
faculty / subject / department	faculty 08 / chemistry / inorganic chemistry
applies to degree courses / semesters	BSC chemistry 3rd/5th semester
module coordinator	Cf. German version
prerequisites	General Chemistry, Inorganic Chemistry 1
course aims	Students should learn the principles of the chemistry of substances of the main group elements and understand the bonding properties and concepts of main group compounds grasp the relationships of theoretical bonding descriptions and the reactivity of molecular compounds and be able to transfer them to other main group compounds
content of module	Composition and chemistry of substances of main group metals and non-metals, technical significance of selected main group elements, element structures of non-metals, semi-metals and their principal compounds, bonding properties and bonding description in small molecules, bonding concepts of electron deficient bonds and hypervalent bonds, selected element-organic compounds
forms of instruction	lecture (15 weeks á 3 h) practical exercises (15 weeks à 1h)
workload in total	lecture attendance hours 45 h preparation, follow-up 15 h practical exercises attendance hours 15 h preparation, follow-up 10 h unsupervised work 20 h examination examination incl. preparation 15 h Σ 120 h
examination admission requirement	active participation in practical exercises
module examination	written examination (2 h)
module grading	written examination (100 %)
form of exam resit	written examination (2 h)
credit points	4 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	90
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK12	**Physical Chemistry Laboratory Course 1**
module description	**Physical Chemistry Laboratory Course 1**
module code	**Chemie-BK12**
faculty / subject / department	faculty 08 / chemistry/ physical chemistry
applies to degree courses / semesters	BSC chemistry, BSc materials science, BSc food chemistry 3rd semester
module coordinator	Cf. German version
prerequisites	General Chemistry Laboratory Course, Physical Chemistry 1
course aims	Students should become acquainted with basic physical chemistry metrology determine basic physical chemistry quantities of thermodynamics, electrochemistry and chemical kinetics by experiments achieve basic skills in drawing up measurement logs and evaluating physical chemistry experiments basic knowledge of data presentation, error estimation and calculation
content of module	**Experiments on phenomenological thermodynamics**: ideal and real gases, calorimetry, 1st law of thermodynamics, thermochemistry, Joule-Thomson effect, partial molar quantities, chemical equilibrium **Experiments on electrochemistry**: conductivity of strong and weak electrolytes, Ostwald's dilution law, ion migration, current-voltage characteristics of electrochemical cells, reversible cell voltage (EMF) and their temperature dependency, concentration chains **Experiments on chemical kinetics**: reactions of 1st and 2nd order, temperature dependency of reaction rate
forms of instruction	laboratory course (12 experiments á 5 h) Seminar (5x 2 h, parallel to lab course)
workload in total	seminar attendance hours 10 h preparation, follow-up 10 h laboratory course attendance hours 60 h preparation, follow-up 40 h unsupervised work 15 h examination examination incl. preparation 15 h Σ 150 h
examination admission requirement	pass in short test on experiments, successful performance of experiments
module examination	protocols
module grading	no grading; module is passed on acceptance of all protocols
form of exam resit	protocols
credit points	5 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	60
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK13	**Analytical Chemistry I**
module description	**Analytical Chemistry I**
module code	**Chemie-BK13**
faculty / subject / department	faculty 08 / chemistry / inorganic and analytical chemistry
applies to degree courses / semesters	BSc chemistry / BSc food chemistry 3rd semester
module coordinator	Cf. German version
prerequisites	General Chemistry
course aims	Students should become acquainted with the fundamentals of chemical analytics learn the basic principles of the entire analytical process learn the principles of analytical quality assurance become familiar with simple separation and enrichment methods
content of module	aims of analytical chemistry analytical processes: taking and preparing samples, measuring, evaluation sensitivity, detection limit, selectivity, precision/accuracy major and minor constituents, trace elements, micro analysis, trace analysis, environmental analytics analytic strategies quality control and quality assurance precipitation reactions gravimetry, quantitative analyses
forms of instruction	lecture (2 h/week) seminar (1 h/week) laboratory course (2 h/week)
workload in total	lecture attendance hours 30 h preparation, follow-up 12 h seminar attendance hours 14 h preparation, follow-up 42 h laboratory course attendance hours 30 h preparation, follow-up 30 h examination examination incl. preparation 22 h Σ 180 h
examination admission requirement	successful completion of laboratory course and seminar
module examination	written examination (2 h) or oral examination
module grading	written examination (100 %)
form of exam resit	written or oral examination
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	60
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

Chemie-BK14	**Organic Chemistry 2**

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module description	**Organic Chemistry 2** (reaction mechanisms and catalysis)
module code	**Chemie-BK14**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSC chemistry 3rd semester
module coordinator	Cf. German version
prerequisites	pass in Organic Chemistry 1
course aims	Students should comprehend all basic organic reaction mechanisms comprehend the frontier molecular orbital theory know simple concepts for stereoselective reaction control know the important catalysed, organic reactions
content of module	molecular orbital theory reaction kinetics and their analysis pericyclic reactions photochemical reactions rearrangements transition state theory reactions of carbonyl compounds HSAB theory Kinetically and thermodynamically controlled reactions organometallic reaction mechanisms catalysis concepts of asymmetric synthesis
forms of instruction	lecture practical exercises
workload in total	lecture attendance hours 45 h preparation, follow-up 45 h practical exercises attendance hours 7 h preparation, follow-up 14 h examination examination incl. preparation 9 h Σ 120 h
examination admission requirement	successful completion 50 % of practical exercises
module examination	written examination (2 h) or oral examination
module grading	final examination (100 %)
form of exam resit	written or oral examination
credit points	4 CP
frequency, duration in semesters	winter semester, 1 semester
language	German or English (as required)
intake capacity of course	250
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK15	**Organic Chemistry Laboratory Course 1**
module description	**Organic Chemistry Laboratory Course 1**
module code	**Chemie-BK15**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSC chemistry 3rd semester
module coordinator	Cf. German version
prerequisites	pass in General Chemistry Laboratory Course, pass in Organic Chemistry 1
course aims	Students should be well-versed in the safe setting up of chemical apparatus be proficient in work safety procedures and safe reaction control be experienced in safe handling of hazardous chemicals and reactions have a command of separation and cleaning methods of organic chemistry be able to conduct simple NMR- IR- and UV spectra evaluations
content of module	basic operations of organic chemistry preparation of simple chemical compounds (e.g. from the Laboratory Book "Organikum") processing and separation techniques reaction controls simple methods of structural analysis
forms of instruction	seminar (1 h/week) laboratory course (12 h/week)
workload in total	laboratory course attendance hours 180 h preparation, follow-up 60 h seminar attendance hours 15 h preparation, follow-up 30 h examination examination incl. preparation 15 h Σ 300 h
examination admission requirement	regular and successful attendance of seminar and laboratory course
module examination	specimens and protocols
module grading	no grading, module is passed when all specimens have been prepared and all protocols accepted
form of exam resit	specimens and protocols
credit points	
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	80
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK16	**Organic Chemistry Laboratory Course 2**
module description	**Organic Chemistry Laboratory Course 2**
module code	**Chemie-BK16**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc chemistry 4th semester
module coordinator	Cf. German version
prerequisites	pass in Organic Chemistry Laboratory Course 1, Organic Chemistry 1 attended
course aims	Students should be proficient in the preparation of complex organic compounds be able to work with shielding gases be able to safely set-up and conduct reactions involving complex reaction conditions be proficient in all aspects of work safety in an organic chemistry laboratory know the principle scientific presentation techniques
content of module	preparation of complex organic compounds synthesis of multi-stage organic specimens working with air- and moisture-sensitive compounds working at low temperatures stereoselective reactions special methods and equipment (e.g. microwave, fluorinated phases, synthesis robot, autoclaves)
forms of instruction	laboratory course seminar
workload in total	laboratory course attendance hours 157 h preparation, follow-up 53 h seminar attendance hours 15 h preparation, follow-up 30 h examination examination incl. preparation 15 h Σ 270 h
examination admission requirement	regular and successful attendance at seminar and laboratory course
module examination	specimens and protocols
module grading	no grading, module is passed when all specimens have been prepared and all protocols accepted
form of exam resit	specimens and protocols
credit points	9 CP
frequency, duration in semesters	summer semester, 1 semester
language	German
intake capacity of course	80
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK17	**Analytical Chemistry II**
module description	**Analytical Chemistry II**
module code	**Chemie-BK17**
faculty / subject / department	faculty 08 / chemistry / inorganic and analytical chemistry
applies to degree courses / semesters	BSc chemistry, BSc food chemistry: 4th semester BSc materials science: elective module
module coordinator	Cf. German version
prerequisites	Analytical Chemistry I
course aims	Students should learn electrochemical analysis methods current separation methods spectroscopic and spectrometric methods of analysis surface analysis and solution based analysis methods chemometric evaluation methods the principles of quality assurance
content of module	electrochemical processes: potentiometry, polarography, voltammetry, conductrometry liquid, gas, thin layer chromatography electrophoretic technique atomic absorption spectroscopy, molecular spectroscopy and spectrometry
forms of instruction	lecture practical exercises
workload in total	lecture attendance hours 60 h preparation, follow-up 60 h practical exercises attendance hours 12 h preparation, follow-up 24 h examination examination incl. preparation 24 h Σ 180 h
examination admission requirement	successful completion of practical exercises, seminar and “Analytical Chemistry I” module
module examination	written or oral examination (2 h)
module grading	written or oral examination examination (100 %)
form of exam resit	written or oral examination
credit points	6 CP
frequency, duration in semesters	summer semester, 1 semester
language	German
intake capacity of course	60
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK18	**Physical Chemistry 2**
module description	**Physical Chemistry 2 – mixed phase thermodynamics, quantum chemistry and spectroscopy**
module code	**Chemie-BK18**
faculty / subject / department	faculty 08 / chemistry / physical chemistry
applies to degree courses / semesters	BSc chemistry 4th semester
module coordinator	Cf. German version
prerequisites	Physical Chemistry 1
course aims	Students should learn the principles of mixed phase thermodynamics be able to calculate states of equilibrium learn statistical methods of thermodynamics understand the basic principles of modern quantum chemistry and perceive these as the basis for spectroscopic methods and *"Computational Chemistry"* grasp quantum chemistry as an important alternative to the classical phenomenological approach (thermodynamics) when it comes to understanding chemical phenomena
content of module	1) Advanced chemical thermodynamics: states of equilibrium of single-component systems, states of equilibrium of two-component systems: liquid-steam, melting diagrams of binary systems, interface thermodynamics, principles of adsorption, introduction to statistical thermodynamics: partition function, Boltzmann distribution (Wedler) 2) Quantum chemistry: limits of classical physics, Schrödinger equation (SE), SE I: free particle, particle in a box, SE II: rigid rotator, SE III: harmonic oscillator, SE IV hydrogen atom, eigenfunctions: graphical representation, molecular orbital theory 3) Spectroscopy: What is spectroscopy? Interaction between electromagnetic radiation and material: UV-Vis, Lambert-Beer law, atom spectroscopy, vibration spectroscopy, magnetic resonance, photoemission spectroscopy
forms of instruction	lecture practical exercises
workload in total	lecture attendance hours 60 h preparation, follow-up 20 h practical exercises attendance hours 30 h preparation, follow-up 50 h unsupervised work 20 h examination examination incl. preparation 30 h Σ 210 h
examination admission requirement	successful completion of 50 % of practical exercises
module examination	written examination (2 h)
module grading	written examination (100 %)
form of exam resit	written examination (2 h)
credit points	7 CP
frequency, duration in semesters	summer semester, 1 semester
language	German
intake capacity of course	60

remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BK19	**Toxicology and Legal Studies**
module description	**Toxicology and Legal Studies**
module code	**Chemie-BK19**
faculty / subject / department	faculty 01 / public law, international law and European law faculty 11 / Institute and Polyclinic for Occupational Safety and Social Medicine
applies to degree courses / semesters	chemistry / materials science, food chemistry 3rd semester
module coordinator	Cf. German version
prerequisites	none
course aims	Module section: Legal Studies Students should be familiar with the basic legal regulations governing the handling of hazardous substances be able to adequately deal with the legal implications arising from the risk of handling hazardous substances and be able to participate in discussions of risk in legal terms acquire expertise qualification according to § 5 Regulation on Prohibition of Chemicals (ChemVerbotsV) thanks to practically orientated training, be in a position to adapt to changing legislation Module section: Toxicology Students should become familiar with the principles of toxicology and its fields of application receive instruction on the sources and forms of possible exposure understand toxicodynamic and toxicokinetic processes and the mechanisms of toxic effects acquire fundamental knowledge of the effect of selected substances and classes of substances be able to apply this knowledge to assess risks
content of module	Module section: Legal Studies the legally prescribed subject matter required for expertise qualification according to the Regulation on Prohibition of Chemicals (ChemVerbotsV), in particular: regulations governing the registration of hazardous substances regulations governing the classification, labelling and packaging of hazardous substances regulations governing the sale and handling of hazardous substances main aspects of hazardous substances legislation including wider implications basic knowledge of questions concerning relevant constitutional, civil and European legislation basic skills in comprehending legal texts basic knowledge on gathering legal information Module section: Toxicology definition and fields of work in toxicology possibilities of incorporation, composition, structure and function of organs and cells, acute and chronic toxicity; exposure-response relationships resorption, distribution, storage, metabolism and secretion of xenobiotics principles of toxic effects and chemical cancerogenesis (difference between concentration and cumulative effects of poison) combination effects risk assessment on the basis of MAK, BLW and BAT values
forms of instruction	lecture
workload in total	Lecture legal studies attendance hours 11 h preparation, follow-up 10 h examination incl. preparation 9 h Lecture toxicology

	attendance hours 11 h preparation, follow-up 10 h examination incl. preparation 9 h Σ 60 h
examination admission requirement	none
module examination	written examination (2 h)
module grading	written examination (100 %)
form of exam resit	written or oral examination
credit points	2 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	120
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BV01	**Inorganic Chemistry 3**
module description	**Inorganic Chemistry 3 – Solid State Chemistry**
module code	**Chemie-BV01**
faculty / subject / department	faculty 08 / chemistry / inorganic chemistry
applies to degree courses / semesters	BSc chemistry $3^{rd}/5^{th}$ semester
module coordinator	Cf. German version
prerequisites	General Chemistry, Inorganic Chemistry 1
course aims	Students should become familiar with and rationalise material properties and structure principles of solids understand methods of determining properties and structure acquire knowledge of selected technically important solids and be able to categorise their property profiles on the basis of the principles learned in the first part of the course
content of module	material properties and structural-property relationship of solids, synthesis methods for solids, structural chemistry of solids, fundamentals of structure investigation of solids, observation of energy and stability, technically important ceramic and metal systems
forms of instruction	lecture (15 weeks á 3 h) practical exercises (15 weeks á 1 h)
workload in total	lecture attendance hours 45 h preparation, follow-up 15 h practical exercises attendance hours 15 h preparation, follow-up 10 h unsupervised work 20 h examination examination incl. preparation 15 h Σ 120 h
examination admission requirement	active participation in practical exercises
module examination	written examination (2 h)
module grading	written examination (100 %)
form of exam resit	written examination (2 h)
credit points	4 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	90
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BV02	**Inorganic Chemistry Laboratory Course 2**
module description	**Inorganic Chemistry Laboratory Course 2**
module code	**Chemie-BV02**
faculty / subject / department	faculty 08 / chemistry / inorganic and analytic chemistry
applies to degree courses / semesters	BSc chemistry 5th semester
module coordinator	Cf. German version
prerequisites	Inorganic Chemistry Laboratory Course 1, Inorganic Chemistry 2 or 3
course aims	Students should become familiar with complex preparation methods of inorganic chemistry represent complex, partly sensitive inorganic compounds gain experience with modern characterisation methods study a topic from literature and present the main aspects in a seminar lecture gain advanced skills in evaluating experiments and drawing up reports become familiar with safety aspects of various methods (e.g. vacuum technique, high temperature processes)
content of module	1. Preparation methods: inert gas synthesis, high temperature synthesis, preparation in evacuated quartz and glass ampoules, multistage molecule and solid-state synthesis (e.g. solid-state synthesis via molecular precursor), chemical transport, intercalation 2. Complex inorganic compounds: nanoparticles (e.g. ferrofluids), colloids, MOF, reactive complex and organometallic compounds 3. Characterisation methods: electron microscopy, X-ray diffraction, UV/VIS, physisorption, DTA, IR/Raman
forms of instruction	laboratory course (26 days á 4 h) seminar (15 x 1 h)
workload in total	laboratory course attendance hours 104 h preparation, follow-up 104 h seminar attendance hours 15 h preparation, follow-up 30 h unsupervised work 17 h Σ 270 h
examination admission requirement	regular attendance of seminar and laboratory course
module examination	protocols, seminar lecture (15 min)
module grading	no grading; module is passed when all protocols have been accepted and a seminar lecture has been successfully held
form of exam resit	protocols, seminar lecture
credit points	9 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	40
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BV03	**Physical Chemistry 3**
module description	**Physical Chemistry 3 – Chemical and Electrochemical Kinetics**
module code	**Chemie-BV03**
faculty / subject / department	faculty 08 / chemistry / physical chemistry
applies to degree courses / semesters	BSc Chemie 5th semester
module coordinator	Cf. German version
prerequisites	Physical Chemistry 1 and Physical Chemistry 2
course aims	Students should achieve a comprehensive understanding of chemical reaction kinetics and transport processes be able to solve basic tasks involving chemical reaction kinetics have a grasp of the theoretic concepts of electrochemistry and perceive these as a central element of numerous physical-chemical problems
content of module	1. kinetics of complex reactions 2. reactions in condensed phases 3. repetition of statistical thermodynamics 4. theory of reaction rate constants (basics and examples) a. kinetic gas theory b. transition state theory c. Butler-Volmer equation 5. transport processes (diffusion, thermal conductivity, migration), application to (electro-)chemical kinetics and interface kinetics 6. (electro-)catalysis
forms of instruction	lecture practical exercises
workload in total	lecture attendance hours 45 h preparation, follow-up 15 h practical exercises attendance hours 30 h preparation, follow-up 40 h unsupervised work 20 h examination examination incl. preparation 30 h Σ 180 h
examination admission requirement	successful completion of 50 % of practical exercises
module examination	oral examination (30 min)
module grading	oral examination (100 %)
form of exam resit	oral examination (30 min)
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	60
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable
Chemie-BV-05	**Physical Chemistry Laboratory Course 2**
module code	**Chemie-BV05**

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faculty / subject / department	faculty 08 / chemistry / physical chemistry
applies to degree courses / semesters	BSc chemistry 6th semester
module coordinator	Cf. German version
prerequisites	Physical Chemical Laboratory Course 1, PC 1, PC 2
course aims	Students should become acquainted with metrology of physical chemistry experimentally determine the physical-chemical quantities of mixed phase thermodynamics, chemical kinetics of complex reactions, electrochemical kinetics, transport theory and spectroscopy acquire advanced skills in writing measurement protocols and evaluating physical-chemical experiments in-depth knowledge of data presentation, error estimation and error calculation
content of module	1. Experiments on mixed phase thermodynamics: partial molar quantities, melting and boiling point diagrams, number of theoretical plates, colligative properties, chemical equilibrium, surface tension 2. Experiments on kinetics of complex reactions: stopped-flow methods, reaction rates and ionic strength, dilatometric determination of reaction rate 3. Experiments on electrochemical kinetics: Butler-Volmer equation, cyclic voltammetry, determination of diffusion potentials, determination of dielectric constants 4. Experiments on transport theory: thermal conductivity of gases, diffusion coefficient of electrolyte solutions 5. Experiments on spectroscopy: scanning tunnelling microscopy, FT-VIS spectroscopy 6. Principles of electric networks
forms of instruction	laboratory course (12 experiments á 5 h) seminar (15 h)
workload in total	seminar attendance hours 15 h preparation, follow-up 5 h laboratory course attendance hours 60 h preparation, follow-up 60 h unsupervised work 25 h examination examination incl. preparation 15 h Σ 180 h
examination admission requirement	confirmation of passed course
module examination	protocols, (oral) presentation
module grading	no grading; module is passed when all protocols have been accepted and a seminar lecture successfully held
form of exam resit	Protocols and (oral) presentation
credit points	6 CP
frequency, duration in semesters	summer semester, 1 semester
language	German
intake capacity of course	60
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

Chemie-BV-04	**Organic Chemistry 3**
module description	**Organic Chemistry 3**

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module code	**Chemie-BV04**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc chemistry 5th semester
module coordinator	Cf. German version
prerequisites	pass in OC-2
course aims	Students should know the principles of retrosynthetic analysis be able to plan organic syntheses selecting appropriate reactions be able to translate common synthons into synthetic equivalents
content of module	concepts of synthesis planning synthon approach synthesis strategy (linear, convergent synthesis) regioselectivity, chemoselectivity an stereoselectivity in synthesis planning of complex molecules protecting groups
forms of instruction	lecture practical exercises
workload in total	lecture attendance hours 45 h preparation, follow-up 45 h practical exercises attendance hours 7 h preparation, follow-up 14 h examination examination incl. preparation 9 h Σ 120 h
examination admission requirement	none
module examination	written examination (2 h) or oral examination
module grading	final examination (100 %)
form of exam resit	written or oral examination
credit points	4 CP
frequency, duration in semesters	winter semester, 1 semester
language	German or English (as required); Literature: English
intake capacity of course	80
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BV06	**Biochemistry**
module description	**Biochemistry**
module code	**Chemie-BV06**
faculty / subject / department	faculty 08 / chemistry / biochemistry
applies to degree courses / semesters	BSc chemistry, BSc food chemistry
module coordinator	Cf. German version
prerequisites	none
course aims	Students should learn the main classes of substances (amino acids, proteins, carbohydrates, lipids, nucleic acids), their biochemical structure, properties and functions become familiar with the structure (constitution, configuration, conformation) of biopolymers and their components in detail develop in-depth understanding of the various mechanisms of enzyme catalysis learn the processes involved in the principle catabolic and anabolic metabolism pathways and their regulation understand the mechanisms of substance transport and signal transduction in molecular detail become familiar with specific metabolic performance on a cell and tissue level learn the most important methods of biochemistry in theory and practice (enzyme kinetics, chromatography, centrifugation, PCR)
content of module	composition, structure and properties of amino acids, peptides and proteins; sugars, oligo- and polysaccharides; fatty acids, neutral fats and phospholipids; nucleobases, nucleotides and nucleic acids modes of action of enzymes, enzyme mechanisms, enzyme kinetics, regulation of enzymes biological membranes, membrane transport biological signal transfer (signal transduction) carbohydrate metabolism (glycolysis, gluconeogeneseis, glycogen metabolism) protein turnover and amino acid metabolism lipid metabolism (fat degradation, β-oxidation, fatty acid synthesis) bioenergetics (citric acid cycle, respiratory chain, oxidative phosphorylation) nucleotide metabolism methods of biochemistry (gel electrophoresis for separation of proteins and nucleic acids, gel filtration, ion exchange and affinity chromatography, centrifugation, PCR): introduction to theoretical principles and implementation in experiments
forms of instruction	lecture (3 h/week) practical exercises (2 h/week) laboratory course (1.3 h/week)
workload in total	lecture attendance hours 45 h preparation, follow-up 55 h practical exercises attendance hours 30 h preparation, follow-up 30 h laboratory course attendance hours 25 h preparation, follow-up 35 h examination examination incl. preparation 20 h Σ 240 h
examination admission requirement	written examination: all experiment protocols accepted
module examination	written examination (2 h)

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module grading	written examination (100 %)
form of exam resit	written examination or final colloquium
credit points	8 CP
frequency, duration in semesters	summer semester, 1 semester
language	German
intake capacity of course	
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BV07	**Bachelor Thesis**
module description	**Bachelor Thesis**
module code	**Chemie-BV07**
faculty / subject / department	faculty 08 / chemistry / all departments
applies to degree courses / semesters	BSc chemistry 6th semester
module coordinator	Cf. German version
prerequisites	modules from semester 1 to 5
course aims	Students should acquire the competence to independently apply scientific methods to a concrete project in a field of chemistry, present and defend their results as a scientific thesis
content of module	drafting a work plan evaluating literature determining methods of synthesis, measurement and evaluation, implementation and evaluation, discussion of results writing the thesis
forms of instruction	all-day instruction working in a scientific team
workload in total	laboratory course attendance hours 280 h examination incl. preparation 80 h Σ 360 h
examination admission requirement	none
module examination	dissertation (thesis) oral presentation (defence)
module grading	dissertation (thesis) (70 %) oral presentation (defence) (30 %)
form of exam resit	In the event of a fail, the thesis must be completely rewritten according to § 34 paragraph 2 clause 2 AllB (General Regulations for Modularised Study Courses)
credit points	12 CP
frequency, duration in semesters	summer semester, winter semester, 1 semester
language	German
intake capacity of course	60
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW01	**Nanochemistry**
module description	**Nanochemistry**
module code	**Chemie-BW01**
faculty / subject / department	faculty 08 / chemistry / inorganic chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science elective module / 5th semester
module coordinator	Cf. German version
prerequisites	General Chemistry, Inorganic Chemistry 1 and 2 or 3
course aims	Students should receive a general view of the synthesis methods in nanochemistry learn the principles governing the shaping and organisation of nanostructures learn to assess the advantages and disadvantages of nanostructured materials
content of module	history of nanochemistry and fields of application, synthesis of nanoparticles (nucleation/growth, colloid particles, stabilization methods), shaping in nanochemistry, applied nanochemistry (nanoelectronics, surface layers)
forms of instruction	lecture (15 weeks á 2 h) seminar (15 weeks á 2 h)
workload in total	lecture attendance hours 30 h preparation, follow-up 15 h seminar attendance hours 30 h preparation, follow-up 20 h unsupervised work 40 h examination incl. preparation 45 h Σ 180 h
examination admission requirement	none
module examination	presentation (30 min), written examination (2 h)
module grading	written examination (50 %), presentation (50 %)
form of exam resit	written examination (2 h)
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	20
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW02	**Modern Concepts of Inorganic Chemistry**
module description	**Modern Concepts of Inorganic Chemistry**
module code	**Chemie-BW02**
faculty / subject / department	faculty 08 / chemistry / inorganic chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science elective module, 6th semester
module coordinator	Cf. German version
prerequisites	Inorganic Chemistry 1-3
course aims	Students should become familiar with new developments in the field of inorganic molecular and solid-state chemistry learn to interpret and present current research results
content of module	inorganic polymers (synthesis of polysilanes, polyphosphazenes, polycarbosilanes), chemistry of thin layers (types of molecular precursors and furnace systems, methods for metallic, semi-conducting and phase transition materials, characterisation of amorphous substances) Presentation of modern research approaches in the fields of material research, catalysis, binding concepts, molecular magnetism, or similar
forms of instruction	lecture (15 weeks á 2 h) seminar (15 weeks á 2 h)
workload in total	lecture attendance hours 30 h preparation, follow-up 15 h seminar attendance hours 30 h preparation, follow-up 20 h unsupervised work 40 h examination incl. preparation 45 h Σ 180 h
examination admission requirement	none
module examination	presentation (30 min), written examination (2 h)
module grading	written examination (50 %), presentation (50 %)
form of exam resit	written examination (2 h)
credit points	6 CP
frequency, duration in semesters	summer semester, 1 semester
language	German
intake capacity of course	20
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW03	**Metal and Ligand Reactivity**
module description	**Metal and Ligand Reactivity**
module code	**Chemie-BW03**
faculty / subject / department	faculty 08 / chemistry / inorganic chemistry
applies to degree courses / semesters	BSc/MSc chemistry / elective module 5th semester
module coordinator	Cf. German version
prerequisites	General Chemistry, Inorganic Chemistry 1 and 2
course aims	Students should receive a general view of the synthesis methods of coordination chemistry learn various methods of investigating the reactivity of coordination compounds become acquainted with the reactivity behaviour and applications of coordination compounds
content of module	principal metal complexes and their reaction behaviour (e.g. metal porphyrins); differing reaction behaviour of free ligands and ligands bonded to the metal cation, analysis techniques such as UVVis spectroscopy, principal organometallic compounds, such as e.g. ferrocene
forms of instruction	lecture (15 weeks á 3 h) seminar (15 weeks á 1 h) practical exercises (15 weeks á 1 h)
workload in total	lecture attendance hours 45 h preparation, follow-up 45 h seminar attendance hours 15 h preparation, follow-up 15 h practical exercises attendance hours 15 h preparation, follow-up 15 h examination incl. preparation 30 h Σ 180 h
examination admission requirement	regular attendance of seminar and active participation in practical exercises
module examination	written examination (100 %)
module grading	written examination (100 %)
form of exam resit	written examination (2 h)
credit points	6 CP
frequency, duration in semesters	winterer semester, 1 semester
language	German
intake capacity of course	35
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW04	**Computational Chemistry/Molecular Modelling**
module description	**Computational Chemistry/Molecular Modelling**
module code	**Chemie-BW04**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module 6th semester
module coordinator	Cf. German version
prerequisites	Organic Chemistry I and II, Physical Chemistry I and II
course aims	Students should receive a practical and theoretical introduction to “Computational Chemistry” and “Molecular Modelling” learn typical approaches used in Computational Chemistry on the basis of case studies be able to select and implement simple computer-aided methods appropriate to chemical problems
content of module	calculation methods: force fields, Hartree-Fock theory, perturbation theory, density functional theory comparison of calculated and measured data concept of potential energy surface computer hardware and software strain and conformational analysis molecular orbital theory basis sets calculation of molecule properties and spectra (IR, Raman, NMR, UV, CD etc.) solvent effects
forms of instruction	lecture (2 h/week) practical exercises (2 h/week)
workload in total	lecture attendance hours 30 h preparation, follow-up 25 h practical exercises attendance hours 30 h preparation, follow-up 60 h examination incl. preparation 35 h Σ 180 h
examination admission requirement	
module examination	report in the form of a scientific publication (in English)
module grading	report (100 %)
form of exam resit	report
credit points	6 CP
frequency, duration in semesters	summer semester, 1 semester
language	German or English (as required); literature: English
intake capacity of course	30
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

Chemie-BW05	**Soft Materials**
module description	**Soft Materials**
module code	**Chemie-BW05**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module 5th semester
module coordinator	Cf. German version
prerequisites	Organic Chemistry I
course aims	Students should possess sound knowledge of non-classical, chemical subject matter and structures in the field of polymer and macromolecular chemistry know the presentation and characterisation of soft chemical materials from various fields, in particular the properties of soft matter
content of module	polymers hybrid materials biomacromolecules colloids membranes liquid crystals amphiphiles foams surfactants gels glasses
forms of instruction	lecture (2 h/week) practical exercises (1 h/week)
workload in total	lecture attendance hours 30 h preparation, follow-up 90 h practical exercises attendance hours 15 h preparation, follow-up 30 h examination incl. preparation 15 h Σ 180 h
examination admission requirement	
module examination	written examination
module grading	written examination (100 %)
form of exam resit	written or oral examination
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	35
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW06	**Scientific Writing and Data Dissemination**
module description	**Scientific Writing and Data Dissemination**
module code	**Chemie-BW06**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module 5th semester
module coordinator	Cf. German version
prerequisites	Organic Chemistry I, Physical Chemistry I, Inorganic Chemistry I
course aims	Students should learn the elements involved in scientific publication have a good command of modern information technology (databases, search engines etc.) acquire the ability to independently outline and document a research project be able to draft a research project including work and time schedule be able to present the results
content of module	evaluation of scientific publications presentation of individual research and investigation results foreign language expressions and characteristics specialised scientific English software for data acquisition and processing
forms of instruction	practical exercises (2 h/week) seminar (2 h/week)
workload in total	practical exercises attendance hours 28 h preparation, follow-up 28 h seminar attendance hours 28 h preparation, follow-up 68 h examination incl. preparation 28 h Σ 180 h
examination admission requirement	
module examination	report presenting investigation or research results in the form of a scientific publication or an application for project funding (100 %)
module grading	report (100 %)
form of exam resit	report
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German and English
intake capacity of course	35
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW07	**Matrix Isolation Technique / Reactive Intermediates**
module description	**Matrix Isolation Technique / Reactive Intermediates**
module code	**Chemie-BW07**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module 6th semester
module coordinator	Cf. German version
prerequisites	Organic Chemistry I and II
course aims	Students should understand the principles of the matrix isolation technique be able to conduct their own experiments under matrix isolation conditions be able to calculate molecule data using quantum mechanical methods to support spectral analysis based on matrix measurements documentation and presentation of findings
content of module	matrix isolation technique: sample preparation, equipment set-up, vacuum and temperature control systems synthesis of suitable precursors for the production of highly reactive and hitherto unknown molecules and intermediates under matrix isolation conditions generation and spectroscopy of reactive intermediates in matrices, independent measurement and interpretation
forms of instruction	laboratory course (2.7 h/week) seminar (0.7 h/week)
workload in total	laboratory course attendance hours 40 h preparation, follow-up 60 h seminar attendance hours 10 h preparation, follow-up 10 h unsupervised work 25 h examination incl. preparation 35 h Σ 180 h
examination admission requirement	
module examination	protocols (60 %) and final oral presentation (40 %) in seminar
module grading	protocols (60 %) and final oral presentation (40 %) in seminar
form of exam resit	protocols, presentation
credit points	6 CP
frequency, duration in semesters	summer semester, 1 semester
language	German or English (as required); literature: English
intake capacity of course	10
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW08	**Catalysis and Synthesis**
module description	**Catalysis and Synthesis**
module code	**Chemie-BW08**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module 5th semester
module coordinator	Cf. German version
prerequisites	pass in Organic Chemistry II
course aims	Students should know the elementary steps of transition metal catalysed reactions know the principal transition metal catalysed reactions be able to use catalyses in synthesis planning understand the effects of various reaction conditions, in particular ligands, on a catalysis cycle
content of module	Pd and Ni catalysis, coupling reactions, cascade reactions, catalysed reductions and oxidations, CC bond strategies, CO insertion, redox catalysis, enzymes, Lewis acid-base catalysis, metathesis planning and implementation of transition metal catalysed reactions ligand tuning, steric and electronic properties of ligands, NHC ligands writing a seminar paper on a selected research topic of current interest
forms of instruction	lecture (2 h/week) seminar (0.3 h/week) practical exercises (1 h/week)
workload in total	lecture attendance hours 30 h preparation, follow-up 30 h seminar attendance hours 5 h preparation, follow-up 35 h practical exercises attendance hours 15 h preparation, follow-up 45 h examination incl. preparation 20 h Σ 180 h
examination admission requirement	none
module examination	written or oral examination (2 h) seminar paper
module grading	written or oral examination (70 %), seminar paper (30 %)
form of exam resit	written or oral examination
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German or English
intake capacity of course	35
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW09	**Natural Products**
module description	**Natural Products**
module code	**Chemie-BW09**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module 5th semester
module coordinator	Cf. German version
prerequisites	pass in Organic Chemistry II
course aims	Students should know the main classes of natural products including their distribution and significance be able to classify characteristic structural elements of natural product classes be familiar with the biosyntheses of the main classes of natural products including the underlying organic-chemical mechanisms be familiar with the standard synthesis methods for the most important classes of natural products (amino acids, carbohydrates, terpenes and polyketides know about current developments in natural products research
content of module	classification of natural products according to structure, function, biosynthesis and occurrence biosyntheses of selected natural product classes explanation of biosynthesis paths enzymatic synthesis function of natural products isolation of natural products identification of natural products synthesis of natural products natural products and search for active ingredients
forms of instruction	lecture (2 h/week) practical exercises (1 h/week)
workload in total	lecture attendance hours 30 h preparation, follow-up 30 h practical exercises attendance hours 15 h preparation, follow-up 45 h examination incl. preparation 60 h Σ 180 h
examination admission requirement	
module examination	written or oral examination and semester paper
module grading	written or oral examination (80 %), semester paper (20 %)
form of exam resit	written or oral examination, correction of semester paper
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German or English (as required)
intake capacity of course	35
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

Chemie-BW10	**Asymmetric Synthesis**
module description	**Asymmetric Synthesis**
module code	**Chemie-BW10**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module $5^{th}/6^{th}$ semester
module coordinator	Cf. German version
prerequisites	pass in Organic Chemistry II
course aims	Students should understand the principles of asymmetric synthesis know the standard chiral auxiliary groups know and understand enantioselective catalysis know the standard chiral ligands and catalysts be familiar with practical methods of asymmetric and enantioselective synthesis including the separation and analysis of the products be familiar with retrosynthetic concepts for the representation of stereo isomerically pure products
content of module	models for diastereoselective synthesis: Cram, Felkin-Ahn, Zimmermann-Traxler, active and passive volume Evans auxiliaries, auxiliary groups of natural products, Enders oximes Bisoxazoline complexes, BINOL complexes, BINAP complexes, Salen complexes and their application in asymmetric catalysis (incl. mechanisms) Biocatalysts, enzymes in organic synthesis racemate separation chiral GC and HPLC, ORD writing a semester paper on a selected research topic of current interest
forms of instruction	lecture (2 h/week) seminar (0.3 h/week) practical exercises (1 h/week)
workload in total	lecture attendance hours 30 h preparation, follow-up 30 h seminar attendance hours 5 h preparation, follow-up 35 h practical exercises attendance hours 15 h preparation, follow-up 45 h examination incl. preparation 20 h Σ 180 h
examination admission requirement	none
module examination	written or oral examination (2 h) seminar paper
module grading	written or oral examination (70 %), seminar paper (30 %)
form of exam resit	written or oral examination
credit points	6 CP
frequency, duration in semesters	1 semester
language	German or English

intake capacity of course	35
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW11	**Radical Chemistry**
module description	**Radical Chemistry**
module code	**Chemie-BW11**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module $5^{th}/6^{th}$ semester
module coordinator	Cf. German version
prerequisites	pass in Organic Chemistry II
course aims	Students should know the structure and reactivity of different radicals understand cascade reactions via radicals know metal catalysed and initiated radical reactions know radical chemical polymerisation methods understand stereoselectivity in reactions via radicals know analytical methods in radical chemistry
content of module	structure and stabilisation of radicals reactivity (nucleophile radicals, electrophile radicals) cascade reactions, planning and implementation, avoiding side reactions stereoselective radical reactions, Beckwith-Houck transition states, using Evans-auxiliaries Sm(II), MN(III), Cu(I), Fe(II), Ru(II), Ce(IV) and Mo(V)- initiated radical reactions Polymerisation via radicals, living polymerisation, copolymers ESR, CINDP writing a seminar paper on a selected research topic of current interest
forms of instruction	lecture (2 h/week) seminar (0.3 h/week) practical exercises (1 h/week)
workload in total	lecture attendance hours 30 h preparation, follow-up 30 h seminar attendance hours 5 h preparation, follow-up 35 h practical exercises attendance hours 15 h preparation, follow-up 45 h examination incl. preparation 20 h Σ 180 h
examination admission requirement	all protocols accepted
module examination	written or oral examination (2 h) seminar paper
module grading	written or oral examination (70 %), seminar paper (30 %)
form of exam resit	written or oral examination
credit points	6 CP
frequency, duration in semesters	1 semester
language	German
intake capacity of course	35
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW12	**Organocatalysis**
module description	**Organocatalysis**
module code	**Chemie-BW12**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	MSc chemistry / elective module; also for scientific staff 6th semester
module coordinator	Cf. German version
prerequisites	pass in Organic Chemistry I, II and III
course aims	Students should learn typical organocatalytic reaction procedures comprehend essential organocatalytic mechanisms be proficient in the application of organocatalytic methods in synthesis and planning of synthesis
content of module	nucleophile catalysis (amines, N-heterocyclic carbenes, phosphines) electrophile catalysis (thiourea, general hydrogen bonding) organocatalysis via non-dissociated salts (AC/DC, phosphoric acid derivatives, etc.)
forms of instruction	seminar (2 h/week) practical exercises (as homework with follow-up discussion, 2 h/week)
workload in total	seminar attendance hours 28 h preparation, follow-up 46 h practical exercises attendance hours 28 h preparation, follow-up 58 h examination incl. preparation 20 h Σ 180 h
examination admission requirement	
module examination	written or oral examination (2 h)
module grading	written or oral examination (100 %)
form of exam resit	written or oral examination
credit points	6 CP
frequency, duration in semesters	summer semester, 1 semester
language	German (English also on arrangement with course participants)
intake capacity of course	30
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW13	**Medical Chemistry**
module description	**Medical Chemistry**
module code	**Chemie-BW13**
faculty / subject / department	faculty 08 / chemistry / organic chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module 6th semester
module coordinator	Cf. German version
prerequisites	pass in Organic Chemistry 2
course aims	Students should be familiar with the principles of physiology and pharmacology know the different processes involved in drug screening understand the molecular causes of selected clinical indications know the effects of selected drugs on a molecular level master the synthesis of selected pharmaceutical substances
content of module	process of drug discovery targets (proteins, DNA, RNA) standard drugs (chemotherapeutics, antivirals, antibiotics, analgesics) incorporation, metabolism, distribution and excretion of drugs prodrugs receptors and enzymes, chirality and receptor binding non-classical targets assays, development and interpretation, dosis-effect relationships agonism and antagonism membranes and membrane permeability structure-activity relationships multivalency in biological systems
forms of instruction	lecture (2 h/week) practical exercises (1 h/week)
workload in total	lecture attendance hours 30 h preparation, follow-up 30 h practical exercises attendance hours 15 h preparation, follow-up 45 h examination incl. preparation 60 h Σ 180 h
examination admission requirement	
module examination	written or oral examination, semester paper
module grading	written or oral examination (80 %), semester paper (20 %)
form of exam resit	written or oral examination, correction of semester paper
credit points	6 CP
frequency, duration in semesters	summer semester, 1 semester
language	German or English (as required)
intake capacity of course	30
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW14	**Advanced Quantum Chemistry**
module description	**Advanced Quantum Chemistry**
module code	**Chemie-BW14**
faculty / subject / department	faculty 08 / chemistry / physical chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module 5th semester
module coordinator	Cf. German version
prerequisites	Physical Chemistry I, Physical Chemistry II
course aims	Students should know the principal concepts of quantum chemistry be proficient in the application of symmetry relationships in quantum chemistry know and be able to apply the main experimental methods of surface chemistry for characterisation purposes be able to apply surface chemistry to a given topic in heterogeneous catalysis and surface modification
content of module	mathematical methods of quantum chemistry MO and FO theory symmetry relationships in quantum chemistry consideration of electron-electron interaction in quantum chemistry simple applications
forms of instruction	lecture (3 h/week) practical exercises (1 h/week)
workload in total	lecture attendance hours 45 h preparation, follow-up 45 h practical exercises attendance hours 15 h preparation, follow-up 45 h examination incl. preparation 30 h Σ 180 h
examination admission requirement	
module examination	written (2 h) or oral (1h) examination
module grading	written or oral examination (100 %)
form of exam resit	written or oral examination
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	30
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW15	**Colloid Chemistry**
module description	**Colloid Chemistry**
module code	**Chemie-BW15**
faculty / subject / department	faculty 08 / chemistry / physical chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module 5th semester
module coordinator	Cf. German version
prerequisites	Physical Chemistry I, Physical Chemistry II
course aims	Students should possess basic knowledge of colloid and interface chemistry and be able to apply this to fundamental problems know the principles of polymer chemistry become acquainted with the principle experimental methods of characterisation (ultracentrifugation, rheology, charge determination, …) have a command of the main synthesis approaches for production of colloids become familiar with the main theoretical concepts of colloid science
content of module	surfaces and interfaces forces in colloid systems tensides/ colloids characterisation methods of colloids: ultracentrifugation, light scattering, determination of surface charges, rheology synthesis of colloid structures (colloids, nanoparticles, pore systems) emulsions (micro- and mini-emulsions)
forms of instruction	lecture (2 h/week) laboratory course (1.6 h/week)
workload in total	lecture attendance hours 30 h preparation, follow-up 30 h laboratory course attendance hours 25 h preparation, follow-up 75 h unsupervised work 18h examination incl. preparation 2 h Σ 180 h
examination admission requirement	
module examination	written (2 h) or oral (1 h)examination
module grading	written or oral examination (100 %)
form of exam resit	written or oral examination
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	30
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW16	**Electrochemistry I**
module description	**Electrochemistry I – from Basics to Applications**
module code	**Chemie-BW16**
faculty / subject / department	faculty 08 / chemistry / physical chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module
module coordinator	Cf. German version
prerequisites	Physical Chemistry I, Physical Chemistry II
course aims	Students should know the basic thermodynamic, kinetic and methodical principles of electrochemistry know the main fields of application for electrochemical processes know the standard experimental methods have a grasp of the theoretical concepts of electrochemistry and comprehend them as an essential part of numerous physical-chemical problems possess in-depth knowledge of current research trends in (solid-state) electrochemistry possess in-depth knowledge of the fundamentals of electrochemical energy technology
content of module	thermodynamic and kinetic principles of electrochemistry (electrolytes, electrodes, cells) interface phenomena experimental methods (characterisation of electrolytes, electrodes and cells) fields of application: battery and fuel cell technology, sensors, corrosion, etc. electrochemistry and solid-state chemistry; Solid State Ionics
forms of instruction	lecture (2 h/week) practical exercises (2 h/week)
workload in total	lecture attendance hours 30 h preparation, follow-up 45 h practical exercises attendance hours 30 h preparation, follow-up 45 h examination incl. preparation 30 h Σ 180 h
examination admission requirement	successful completion of 50 % of practical exercises
module examination	written or oral examination
module grading	written or oral examination (100 %)
form of exam resit	written or oral examination
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	30
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW17	**Electrochemistry II**
module description	**Electrochemistry II – Electrochemical Energy Technologies**
module code	**Chemie-BW17**
faculty / subject / department	faculty 08 / chemistry / physical chemistry
applies to degree courses / semesters	BSc/MSc chemistry / elective module
module coordinator	Cf. German version
prerequisites	Physical Chemistry I, Physical Chemistry II, Electrochemistry I
course aims	Students should have knowledge of the electrochemical basics of electrochemical energy technologies fuel cells, their basic principles and function, current research trends batteries, their basic principles and function, current research trends photoelectrochemical systems, their basic principles and current research status various energy storage substances and associated electrochemical technologies ionic conductivity in various phases as a basis for the development of electrolytes electrode kinetics as an essential element of fuel cells and batteries
content of module	synopsis of required knowledge in thermodynamics, kinetics and methodology fuel cells batteries, in particular lithium ion batteries photoelectrochemical cells general principles of electrochemical energy converters and storage devices in connection with energy networks
forms of instruction	lecture (2 h/week) practical exercises (2 h/week)
workload in total	lecture attendance hours 30 h preparation, follow-up 45 h practical exercises attendance hours 30 h preparation, follow-up 45 h examination incl. preparation 30 h Σ 180 h
examination admission requirement	successful completion of 50 % of practical exercises
module examination	written or oral examination
module grading	written or oral examination (100 %)
form of exam resit	written or oral examination
credit points	6 CP
frequency, duration in semesters	summer semester, 1 semester
language	German
intake capacity of course	30
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

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Chemie-BW18	**Solid-State Reactions**
module description	**Solid-State Reactions**
module code	**Chemie-BW18**
faculty / subject / department	faculty 08 / chemistry / physical chemistry
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science, elective module
module coordinator	Cf. German version
prerequisites	Physical Chemistry I, Physical Chemistry II
course aims	Students should know the role of solid-state reactions in nature and modern technology know the mechanisms of typical solid-state reactions know the most important methods of studying solid-state reactions know several important applications of solid-state reactions (functional ceramics, semi-conductor technology, solid-state synthesis)
content of module	transport processes as a basis for transporting solid-state substances laws of growth morphology and shaping during solid-state reactions degradation and ageing of solids surface and interface reactions experimental methods examples: high-temperature corrosion, intercalation and insertion in solids, hydrogen storage, membrane technology
forms of instruction	lecture (15 weeks á 2 h), seminar (15 weeks á 2 h)
workload in total	lecture attendance hours 30 h preparation, follow-up 15 h seminar attendance hours 30 h preparation, follow-up 20 h unsupervised work 40 h examination incl. preparation 45 h Σ 180 h
examination admission requirement	none
module examination	presentation (30 min), written examination (2 h)
module grading	written examination (50 %), presentation (50 %)
form of exam resit	written examination (2 h)
credit points	6 CP
frequency, duration in semesters	winter semester, 1 semester
language	German
intake capacity of course	20
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable

Chemie-BW19	**Study Project**
module code	**Chemie-BW19**
faculty / subject / department	faculty 08 / chemistry / all chemistry departments
applies to degree courses / semesters	BSc/MSc chemistry, BSc/MSc materials science / elective module 5th or 6th semester
module coordinator	Cf. German version
prerequisites	
course aims	Students should, on completion of the project, have put the methods of a specialised field to the test and have broadened their knowledge and skills within a team improved their skills in literature research and scientific discussion become practised in the application of multimedia presentations techniques taking didactic aspects into account
content of module	viewing literature using modern devices for the manufacture and characterisation of materials implementation of a work programme discussion and presentation of results writing weekly interim reports and final report
forms of instruction	laboratory course (8 h/week) seminar (0.3 h/week) 3-week participation in an ongoing research and development project in an external establishment (industry or research facility) or in an institute participating in study course in agreement with a module coordinator. Progress is monitored by a university teacher by means of written weekly reports.
workload in total	practical exercises attendance hours 120 h preparation, follow-up 15 h seminar attendance hours 5 h preparation, follow-up 15 h examination incl. preparation 25 h Σ 180 h
examination admission requirement	
module examination	report (written or oral)
module grading	report (100 %)
form of exam resit	report
credit points	6 CP
frequency, duration in semesters	summer or winter semester, 1 semester
language	German
intake capacity of course	30
remarks	module advice and reading list: please see separate list for current semester date: see lecture timetable