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MatWiss-BP 01	**Experimental Physics I**	**1st semester**	**9 CP**

Module description	Experimental Physics I - Mechanics and Thermodynamics
Module code	MatWiss-BP 01
Faculty/Subject/Department	Faculty 07/Physics
Associated degree course(s)/Semester taken	BSc Physics, BSc Advanced Materials, minor subject: Mathematics
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall: • have knowledge of the fundamental phenomena and principles of the subject areas of mechanics and thermodynamics • master the fundamental terminology and laws of conservation • be able to describe the phenomena mathematically and develop solutions to simple problems • have the ability to ascertain the principles of simple experiments from the relevant literature • have knowledge of basic measurement instruments • be able to solve experimental exercises in a team • be able to appropriately illustrate experimental results
Module content	Basic quantities, kinematics, Newtonian axioms, forces in nature, inertial forces, momentum, work and energy, angular momentum, statics and dynamics of fixed bodies, relativistic mechanics, mechanics of deformable media, mechanical oscillations and waves, acoustics, kinetic gas theory, laws of thermodynamics, real gas and phase transitions, forms of heat transfer, physical measurement technology
Form(s) of instruction	• Lecture (4 hours/week) • Tutorial (2 hours/week) in small groups: calculation of examples related to topics covered in preceding lectures • Block of labs following end of lectures: 10 experiments (20 hours)
Total workload in hours	30 hours — Credit points: 1 ECTS credit

Module composition / Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	60	20	10	15	105
Tutorial	30	30	30	0	90
Laboratory	20	30	10	15	75
Total	110	80	50	30	**270**

Examination requirements	Written examination on lecture: 2/3 of tutorial problems must be solved successfully Written examination on laboratory: all laboratory reports must be accepted and the final test completed.
Form(s) of examination and contribution to final mark	Form: Written examination on lecture (2 hours); minimum pass mark: 50% Written examination or final colloquium on laboratory (1 hour) Contribution to final mark: Written examination on lecture: 75% Written examination or final colloquium on laboratory: 25%
Module retake examination	Written examination or final colloquium
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BA06	**Mathematics**	**1st semester**	**7 CP**

Module description	Mathematics
Module code	MatWiss-BA06
Faculty/Subject/Department	Faculty 07/Physics, Faculty 08/Chemistry
Associated degree course(s)/Semester taken	BSc Che, BSc Advanced Materials, BSc LmCh, L3 Che
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall have the ability to use the following mathematical methods to describe chemical and physical processes: • vector arithmetic • matrix calculus • differential and integral calculus of one or multivariable functions • the field of differential equations
Module content	• Analysis: numbers, sequences, series, functions (polynomials, e, ln, sin, cos, tan, cos, arcus), complex numbers, continuity, one-dimensional differential and integral calculus, Taylor series, solving of simple linear and inhomogeneous differential equations, differential calculus of multivariable functions (total differential), integral calculus with multiple variables, line integrals, partial differential equations using the example of the wave equation. • Linear Algebra: vectors, matrices, solving of linear equation systems, determinants, eigenvalues, eigenvectors .
Form(s) of instruction	• Lecture (4 hours/week) • Tutorial (2 hours/week)
Total workload in hours	210 hours — Credit points: 7 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	60	20	10	10	100
Tutorial	30	50	10	20	110
Total	90	70	20	30	**210**

Examination requirements	50% of tutorial problems must be successfully solved.
Form(s) of examination and contribution to final mark	2 written examinations (each 2 hours) Average of both written examinations: 100%
Module retake examination	Written examination
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BC 01	**General Chemistry**	**1st semester**	**6 CP**

Module description	General Chemistry
Module code	MatWiss-BC 01
Faculty/Subject/Department	Faculty 08/Chemistry/All chemistry departments
Associated degree course(s)/Semester taken	BSc Chemistry, BSc Advanced Materials, BSc Food Science/1st semester
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall: • be familiar with the fundamental physical-chemical properties, material states and bond forms as well as the fundamentals of thermodynamics, the principles of chemical equilibrium and of electrochemistry • have knowledge of the periodic table and the interrelationships within the periodic system, the valence notation and chemical bonding models, the law of mass action, acid-base theories, redox reactions and simple inorganic-chemical compounds and their properties • be familiar with the fundamentals of the organic-chemical nomenclature, forms of isomerism, organic-chemical material groups and their properties and the most important classes of natural substances • have knowledge of everyday chemical phenomena, be able to explain these and relate them to the topics covered in the lecture
Module content	• **PC:** Structure of matters, aggregate states, separation, the term "element", structure of atoms, isotopes, electron configurations, periodic system, definition of the mole, ideal gas law, energy and entropy, thermodynamic principles, fundamentals of kinetics, chemical compounds (metallic bonds, ionic bonds, covalent bonds). • **IC:** Valence formulae and mesomerism, chemistry of the main groups, properties of important bonds, simple chemical calculations, law of mass action, solubility product, acid-base analysis, pH-value, pKs-value, buffers, redox reactions, electrochemistry, electrolysis, galvanic elements, Nernst-equation. • **OC:** Hybridisation, bonds in organic chains, alkanes, alkenes, alkynes, aromatics, isomerism, simple nomenclature, redox reactions, optical activity, CIP conventions, concept of functional groups, important organic material groups.
Form(s) of instruction	• Lecture (4 hours/week) • Tutorial (0.8 hours/week)
Total workload in hours	180 hours — Credit points: 6 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	60	60		24	144
Tutorial	12	24			36
Total	72	84		24	**180**

Examination requirements	None
Form(s) of examination and contribution to final mark	Written examination (2 hours): 100%
Module retake examination	Written examination
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	250
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BC 02	**General Chemistry Laboratory**	**1st semester**	**6 CP**

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Module description	General Chemistry Laboratory Introduction
Module code	MatWiss-BC 02
Faculty/Subject/Department	Faculty 08/Chemistry/All chemistry departments
Associated degree course(s)/Semester taken	BSc Chemistry, BSc Advanced Materials, BSc Food Science/1st semester
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students: • understand how fundamental practical laboratory work is undertaken in terms of good laboratory practice • can record their laboratory results in the form of laboratory notebooks and reports • have a command of the fundamental quantitative and qualitative methods for the analysis of matters • understand and can apply basic separation processes • can plan, set up, undertake and analyse simple chemical and physical-chemical experiments
Module content	• "Lab licence" (working safely in a laboratory) • Acids and bases, pH-value, chemical equilibrium, titrations • Redox reactions, galvanic elements, redox potentials • Balancing constants, solubility product • Complexation • Filtration, crystallisation, distillation, chromatography • Inorganic and organic detection reactions • Organic-chemical laboratory techniques • Simple organic-chemical experiments • Fundamental experiments related to energy of chemical reactions (exothermic, endothermic, exergonic, endergonic), to chemical equilibrium and to electrochemistry
Form(s) of instruction	• Laboratory (3.7 hours/week) • Seminar (2.3 hours/week)
Total workload in hours	180 hours — Credit points: 6 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Laboratory	56	56			112
Seminar	34	34			68
Total	90	90			**180**

Examination requirements	Regular attendance at laboratory and seminar
Form(s) of examination and contribution to final mark **Module retake examination**	Form: Laboratory reports Mark: No mark will be given; students pass the module if all reports are accepted for submission.
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	250
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BA 01	**IT Basics**	**1st semester**	**4 CP**

Module description	IT Basics
Module code	MatWiss-BA 01
Faculty/Subject/Department	Faculty 07/Physics, Faculty 08/Chemistry
Associated degree course(s)/Semester taken	BSc Advanced Materials
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall: • understand and recognise the versatile fields of application of the computer for data collection, calculations, data analysis, data visualisation and for the exchange of data in networked systems • autonomously undertake and solve fundamental problems in this central area
Module content	• Text processing and presentation programmes (Word, PowerPoint) • Carrying out calculations using a computer (e.g. Excel, Maple, Mathematica) • Data analysis and visualisation (e.g. Origin/Excel) • Exchange of data and data collection (Internet)
Form(s) of instruction	• Lecture (0.7 hours/week) • Tutorial (1.3 hours/week)
Total workload in hours	120 hours — Credit points: 4 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	8	12	10	0	30
Tutorial	30	50	10	0	90
Total	38	62	20	0	**120**

Examination requirements	
Form(s) of examination and contribution to final mark **Module retake examination**	Tutorial problem sets Tutorial problem sets: 100% Form: Tutorial problem sets
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BP 02	**Experimental Physics II**	**2nd semester**	**9 CP**

Module description	Experimental Physics II - Electrical Science and Optics
Module code	MatWiss-BP 02
Faculty/Subject/Department	Faculty 07/Physics
Associated degree course(s)/Semester taken	BSc Physics, BSc Advanced Materials, minor subject: Mathematics
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall: • have knowledge of the fundamental phenomena and physical principles within the sub-areas of electricity and optics • master the fundamental terms and conservation laws of physics, have the ability to develop experimental exercises from the literature, mathematically describe these and solve them within a team
Module content	Electrostatics, electrical power, magnetostatic energy, induction, application fields of electromagnetism, electrical and magnetic properties of matter, Maxwell equations, electrical oscillations and waves, light as an electromagnetic wave, geometrical optics, wave optics, fundamentals of quantum and wave mechanics, simple examples, physical measurement technology
Form(s) of instruction	• Lecture (4 hours/week) • Tutorial (2 hours/week) in small groups: calculation of examples related to topics covered in preceding lectures • Block laboratory following end of lectures: 10 experiments (20 hours)
Total workload in hours	270 hours — Credit points: 9 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	60	20	10	15	105
Tutorial	30	30	30	0	90
Laboratory	20	30	10	15	75
Total	110	80	50	30	**270**

Examination requirements	Written examination on lecture: 2/3 of tutorial problems must be solved successfully Written examination on laboratory: all laboratory reports must be accepted and the final test completed
Form(s) of examination and contribution to final mark	<u>Form:</u> Written examination on lecture (2 hours); minimum pass mark: 50% Written examination or final colloquium on laboratory (1 hour) <u>Contribution to final mark:</u> Written examination on lecture: 75% Written examination or final colloquium on laboratory: 25%
Module retake examination	Written examination or final colloquium
Frequency, duration	Annually, summer semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BC 03	**Inorganic Chemistry**	**2nd semester**	**4 CP**

Module description	Inorganic Chemistry - Chemistry of Transition Metals
Module code	MatWiss-BC 03
Faculty/Subject/Department	Faculty 08/Chemistry/Inorganic Chemistry
Associated degree course(s)/Semester taken	BSc Chemistry, BSc Advanced Materials, BSc Food Science/2nd semester
Module coordinator	Cf. German Version
Prerequisites	General Chemistry
Learning outcomes	Students shall: • learn the principles of the chemistry of the secondary group elements and recognise trends related to reactivity and structure • become familiarised with bonding concepts of complex chemistry and be able to analyse these in relation to other bonding models
Module content	Production and chemistry of secondary group metals, trends in reactivity and structure in bonds between secondary group elements, complex chemical concepts (nomenclature, ligand fields, ligand exchanges), important macro-technical processes (blast furnace, copper refining, titanium oxide, precious metal extraction)
Form(s) of instruction	• Lecture (3 hours/week/15 weeks) • Tutorial (1 hour/week/15 weeks)
Total workload in hours	120 hours — Credit points: 4 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	45	15	10	10	80
Tutorial	15	10	10	5	40
Total	60	25	20	15	**120**

Examination requirements	Active participation in tutorial
Form(s) of examination and contribution to final mark	Written examination (2 hours) Written examination: 100%
Module retake examination	Written examination (2 hours)
Frequency, duration	Annually, summer semester; 1 semester
Intake capacity	90
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BC 04	**Organic Chemistry**	**2nd semester**	**4 CP**

Module description	Organic Chemistry
Module code	MatWiss-BC 04
Faculty/Subject/Department	Faculty 08/Chemistry/Inorganic Chemistry
Associated degree course(s)/Semester taken	BSc Chemistry/2nd semester, BSc Advanced Materials /2nd semester
Module coordinator	Cf. German Version
Prerequisites	Successful completion of General Chemistry
Learning outcomes	Students shall: • recognise functional groups and be able to analyse their fundamental reactivity • master the fundamental structures and properties of organic-chemical material groups including their nomenclature • understand the bonding relationships within C-X single and multiple bonds • recognise and understand all forms of isomerism in organic molecules, in particular stereo-isomerism • have knowledge of the basic organic reaction mechanisms • be able to record and describe basic reaction mechanisms
Module content	• Alkanes, alkenes, alkynes, aromatics, alcohols, amines, carbonyl bonds and their fundamental reactions including fundamental mechanisms • Simple molecular orbital theory, conformation analysis • Principle of potential energy surface, reactivity-selectivity principle, thermodynamic and kinetic control • Simple heterocycles • Radical reactions, chain reactions • S_n-reactions • Stereochemistry • Addition and elimination • Conjugation and hyper conjugation, resonance, aromaticity • Substitution reactions of aromatics • Pericyclic reactions • Fundamental carbonyl chemistry • Classes of natural substances
Form(s) of instruction	• Lecture (3 hours/week) • Tutorial (0.5 hours/week)
Total workload in hours	120 hours — Credit points: 4 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	45	45		9	99
Tutorial	7	14			21
Total	52	59		9	**120**

Examination requirements	A mark of 50% or more in tutorial.
Form(s) of examination and contribution to final mark	Written examination (2 hours) Written examination: 100%
Module retake examination	Written or oral examination
Frequency, duration	Annually, summer semester; 1 semester
Intake capacity	150
Language of instruction	German or English (depending on demand); literature: English

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BC 05	**Physical Chemistry**	**2nd semester**	**7 CP**

Module description	Physical Chemistry – Thermodynamics and Electrochemistry
Module code	MatWiss-BC 05
Faculty/Subject/Department	Faculty 08/Chemistry/Physical Chemistry
Associated degree course(s)/Semester taken	BSc Chemistry, BSc Advanced Materials, BSc Food Science/2nd semester
Module coordinator	Cf. German Version
Prerequisites	General Chemistry or Mathematics
Learning outcomes	Students shall: • master the basic laws in the fields of chemical thermodynamics, electrochemistry and of chemical kinetics • be familiar with the physical-chemical approaches to these important fields within chemistry and be able to apply these to neighbouring disciplines
Module content	1) Introduction to thermodynamics: ideal and real gases, thermal and caloric equations of state, 1st law, thermochemistry, Carnot processes, entropy, Joule-Thomson effect, partial molar quantity, fundamental equations of thermodynamics, chemical potential, chemical equilibrium, phase equilibria, miscible phase thermodynamics (phase diagram) 2) Electrochemistry: fundamental terms, ionic migration, weak and strong electrolytes, fixed electrolytes, reversible cell potential, electrical dipole coating, electrochemical potential, electrode potential, half cells, half-cell potential, Stockholm convention, diffusion potential, different types of galvanic cells: chemical cells, concentration cells (e.g. lambda probe). 3) Fundamental terms of chemical kinetics: Arrhenius equation, reaction of nth order, dynamic equilibrium, quasi steady-state
Form(s) of instruction	• Lecture (4 hours/week) • Tutorial (2 hours/week)
Total workload in hours	210 hours — Credit points: 7 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	60	20	10	10	100
Tutorial	30	50	10	20	110
Total	90	70	20	30	**210**

Examination requirements	A mark of 50% or more for tutorial problem sets
Form(s) of examination and contribution to final mark	Written examination (120 minutes) Written examination: 100%
Module retake examination	Written examination (120 minutes)
Frequency, duration	Annually, summer semester; 1 semester
Intake capacity	90
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BC 06	**Inorganic Chemistry Laboratory**	**2nd semester**	**6 CP**

Module description	Inorganic Chemistry Laboratory
Module code	MatWiss-BC 06
Faculty/Subject/Department	Faculty 08/Chemistry/Inorganic and Analytical Chemistry
Associated degree course(s)/Semester taken	BSc Chemistry, BSc Advanced Materials, BSc Food Science/2nd semester
Module coordinator	Cf. German Version
Prerequisites	General Chemistry Laboratory, General Chemistry
Learning outcomes	Students shall: • learn fundamental inorganic-chemical preparation methods • prepare the fundamental types of inorganic bonds • acquire knowledge of the substance chemistry of the chemicals covered through lab work • gain experience in the characterisation of prepared substances • become familiar with the different aspects of safety in chemical laboratories
Module content	1) Experiments on preparation methods: wet chemistry (dissolving, decomposing, precipitating), reactions with gases, oxidations and reductions, fused-salt electrolysis, solid state reactions, melting of sensitive preparations 2) Experiments on fundamental types of inorganic bonds: element oxide-halogenide, -nitride and -sulfide, zeolite, gases, main group molecules, coordination bonds, metal-organic bonds 3) Characterisation methods: IR/Raman, NMR, LFS
Form(s) of instruction	• Laboratory (4 hours/day/15 days) • Tutorial (1 hour x 15) accompanying the lab • Seminar (1 hour x 15)
Total workload in hours	180 hours — Credit points: 6 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Prepara-tion/revision			
Lecture	15	30			45
Tutorial	15	30			45
Laboratory	60	30			90
Total	90	90	0	0	**180**

Examination requirements	Regular and active participation in the seminar and laboratory, active participation in tutorials.
Form(s) of examination and contribution to final mark **Module retake examination**	Form: Lab reports Mark: No mark will be given; students pass the module if all lab reports are accepted for submission. Lab reports
Frequency, duration	Annually, summer semester; 1 semester
Intake capacity	60
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BP 03	**Experimental Physics III**	**3rd semester**	**7 CP**

Module description	Experimental Physics 3 – Structure of Matters
Module code	MatWiss-BP 03
Faculty/Subject/Department	Faculty 07/Physics
Associated degree course(s)/Semester taken	BSc Advanced Materials, L3 Physics
Module coordinator	Cf. German Version
Prerequisites	Experimental Physics I, Experimental Physics II
Learning outcomes	Students shall: • have knowledge of the structure and content of modern (non-classical) physics • understand the interdisciplinary interrelationships with other disciplines • be able to autonomously develop an understanding of new, current topics • be able to appropriately formulate problems of modern physics and quantitatively solve simple examples
Module content	• Fundamental effects of quantum physics • Atomic structure, spectroscopy, hydrogen atom, laser • Bond types, molecular physics, crystals • Structure and stability of atomic nuclei, nuclear energy, elementary particles
Form(s) of instruction	• Lecture (3 hours/week) • Tutorial (2 hours/week)
Total workload in hours	210 hours — Credit points: 7 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	45	50	10	15	120
Tutorial	30	40	10	10	90
Total	75	110	30	25	**210**

Examination requirements	Written examination: 50% of tutorial problems must be solved successfully.
Form(s) of examination and contribution to final mark	Written examination (2 hours) Written examination: 100%
Module retake examination	Written examination or final colloquium
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BP 04	**Theoretical Physics**	**3rd semester**	**8 CP**

Module description	Theoretical Physics – Mechanics and Quantum Mechanics
Module code	MatWiss-BP 04
Faculty/Subject/Department	Faculty 07/Physics
Associated degree course(s)/Semester taken	BSc Advanced Materials, L3 Physics
Module coordinator	Cf. German Version
Prerequisites	Experimental Physics I, Experimental Physics II
Learning outcomes	Students shall: • understand the role of mathematics in the construction of models and theories within physics • comprehend the mathematical description of the mechanics of the mass point to the movement in the central field as well as the Lagrange and Hamilton equations • understand the limitations of classical physics and thus the necessity for quantum mechanics • be able to solve simple quantum mechanics problems
Module content	• Mechanics of a mass point: oscillations, movement in the nucleus potential, movements in a rotating coordinate system, differentiation and integration in simple coordinate systems, dynamics of point particles, extremal principle, Lagrange and Hamilton dynamics, symmetries and conservation laws, dynamics within Poisson brackets, fundamental Poisson brackets and dynamic invariants. • Historical development of quantum mechanics: eigenvalues and eigen functions, commutator algebra, free Schrödinger equation and wave packets, tunnel effect, single particle potentials and quantisation of harmonic oscillators, quantisation of angular momentum, electron spin, energy level of the hydrogen atom, entangled states.
Form(s) of instruction	• Lecture (4 hours/week) • Tutorial (2 hours/week)
Total workload in hours	240 hours — Credit points: 8 ECTS credits

7Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Prepara-tion/revision			
Lecture	60	60	15	15	150
Tutorial	30	40	10	10	90
Total	90	100	25	25	**240**

Examination requirements	
Form(s) of examination and contribution to final mark	2 written examinations (3 hours each) Tutorial problem sets 2 written examinations: 80% Tutorial problem sets: 20%
Module retake examination	Written examination
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BC 07	**Organic Chemistry Laboratory**		**3rd semester**		**6 CP**
Module description	Organic Chemistry Laboratory				
Module code	MatWiss-BC 07				
Faculty/Subject/Department	Faculty 08/Chemistry/Organic Chemistry				
Associated degree course(s)/Semester taken	BSc Chemistry, BSc Advanced Materials /3rd semester				
Module coordinator	Cf. German Version				
Prerequisites	Successful completion of General Chemistry Laboratory, Organic Chemistry				
Learning outcomes	Students shall: • master the safe set-up of chemical equipment • master aspects of operational safety and safe reaction control • master the safe use of dangerous chemicals and reactions • master organic-chemical separation and extraction methods • be able to analyse simple NMR, IR and UV spectra • be able to autonomously undertake single step organic reactions				
Module content	• Organic-chemical unit operations • Preparation of simple chemical compounds (e.g. from the Organikum) • Extraction and separation methods • Reaction control • Simple methods for structure analysis				
Form(s) of instruction					
Total workload in hours	180 hours			Credit points: 6 ECTS credits	
Module composition/Workload in hours		A Course		B Autonomous work	C Final module examination incl. preparation	Total
		a Contact hours	b Preparation/revision			
	Laboratory	90	30		15	135
	Tutorial	15	30			45
	Total	105	65		15	**180**
Examination requirements	Successful completion of laboratory and lab reports				
Form(s) of examination and contribution to final mark	Form: Laboratory reports and preparations Mark: No mark will be given; the students pass the module if all lab reports are accepted for submission.				
Module retake examination	Preparations and protocols				
Frequency, duration	Annually, winter semester; 1 semester				
Intake capacity	80				
Language of instruction	German				

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BC 08	**Physical Chemistry Laboratory**	**3rd semester**	**5 CP**

Module description	Physical Chemistry Laboratory
Module code	MatWiss-BC 08
Faculty/Subject/Department	Faculty 08/Chemistry/Physical Chemistry
Associated degree course(s)/Semester taken	BSc Chemistry, BSc Advanced Materials, BSc Food Science
Module coordinator	Cf. German Version
Prerequisites	Successful completion of General Chemistry Laboratory, Physical Chemistry I
Learning outcomes	Students shall: • be familiarised with fundamental physical-chemical measurement methods • experimentally determine fundamental physical-chemical properties of thermodynamics, electrochemistry and chemical kinetics • develop skills in recording and reporting measurements and in the analysis of physical-chemical experiments • develop fundamental skills in data presentation, uncertainty estimation and uncertainty calculation
Module content	1) Experiments on phenomenological thermodynamics: ideal and real gases, calorimetry, first law of thermodynamics, thermochemistry, Joule-Thompson effect, partial molar quantity, chemical equilibrium 2) Experiments on electrochemistry: conductivity of strong and weak electrolytes, Ostwald's law of dilution, ionic migration, current-voltage characteristics, electrochemical cells, reversible cell potential (EMF) and its temperature dependency, concentration chains 3) Experiments on chemical kinetics: reactions of the 1st and 2nd order, temperature dependency of reaction speeds
Form(s) of instruction	Laboratory (12 experiments, each 5 hours) Seminar (2 hours x 5; accompanying the laboratory)
Total workload in hours	150 hours — Credit points: 5 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Seminar	10	10	5	5	30
Laboratory	60	40	10	10	120
Total	70	50	15	15	**150**

Examination requirements	Successful completion of test and experiments
Form(s) of examination and contribution to final mark	Form: Laboratory reports Mark: No mark will be given; the students pass the module if all lab reports are accepted for submission.
Module retake examination	Lab reports
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	60
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BM 01	**Advanced Materials I**	**3rd semester**	**4 CP**

Module description	Advanced Materials I – Introduction
Module code	MatWiss-BM 01
Faculty/Subject/Department	Faculty 07/Physics, Faculty 08/Chemistry
Associated degree course(s)/Semester taken	BSc Advanced Materials /3rd semester
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall: • acquire a fundamental factual knowledge of advanced materials: substance classes, important material properties • be familiarised with methods for the classification of matters according to their properties • acquire fundamental knowledge regarding the interrelationships between material states (solid, fluid, gas, plasma) and properties • acquire fundamental knowledge regarding the interrelationships between material classes and functions • gain an overview of the fundamental process for the production and machining of materials • have a strong command of the relevant scientific vocabulary and terminology • gain an overview of the themes, content and methodology of the lectures Advanced Materials I to IV
Module content	• Structure of matter (fundamentals) • preparation of matter (solid-solid reactions, gas phase reactions, synthesis from the melt, solution, sol-gel, CVD, PLD, MBE, VLS, liquid-phase epitaxy, etc.) • Differentiation of matter according to their basic properties and applications, structure-quantity relationships • Structure of matter with multiple phases and alloys • Fundamentals of representations in phase diagrams • Mechanical material properties (elasticity, plasticity, cracks and breakage) • Heat treatment • Chemical and tribological properties • Fundamentals of electrical, optical, and magnetic properties
Form(s) of instruction	• Lecture (2 hours/week) • Tutorial (1 hour/week)
Total workload in hours	120 hours — Credit points: 4 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	30	15	15	0	60
Tutorial	15	20	10	15	60
Total	45	35	25	15	**120**

Examination requirements	None
Form(s) of examination and contribution to final mark	Written examination Written examination: 100%
Module retake examination	Written examination
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BA 02	**Toxicology and Law**	**5th semester**	**2 CP**
Module description	Toxicology and Law		
Module code	MatWiss-BA 02		
Faculty/Subject/Department	Faculty 01/Law, Faculty 11/Medicine		
Associated degree course(s)/Semester taken	BSc Chemistry/5th semester, BSc Advanced Materials /5th semester, BSc Food Science/3rd semester		
Module coordinator	Dean, Faculty 08		
Prerequisites	None		
Learning outcomes	<u>Module component: Legal studies</u> Students shall: • be aware of the fundamental legal requirements when dealing with dangerous substances • be able to deal with dangerous substances in an adequate manner from a legal point of view and participate in the legal risk discourse • acquire the attestation of competence according to § 5 of the restriction ordinance on chemicals • be in a position to adapt to the relevant legal requirements through the experience gained in practical work <u>Module component: Toxicology</u> Students shall: • learn the fundamentals and fields of work of toxicology • be informed about the sources and forms of possible exposures • understand toxicodynamic and toxicokinetic processes and mechanisms of toxicological effects • gain fundamental knowledge of the functioning modes of selected substances or substance classes • be able to apply the fundamentals of risk assessment		
Module content	<u>Legal studies</u> • The legally mandatory content for the attestation of competence according to the restriction ordinance on chemicals, in particular: • Regulations regarding the registration of dangerous substances • Regulations regarding the classification, labelling, and packaging of dangerous substances • Regulations regarding the dispensing and use of dangerous substances • Fundamentals of dangerous substances law in a wider context • Fundamental knowledge of relevant questions related to constitutional, civil and European law • Fundamental skills in the understanding of legal texts • Fundamental skills in the acquisition of legal information <u>Toxicology</u> • Definition and field of work of toxicology • Incorporation possibilities as well as composition, structure and functions of organs and cells • Acute and chronic toxicity, dose-effect relationship • Resorption, distribution, storage, metabolism and expulsion of foreign substances • Toxic effect mechanisms and chemical carcinogenesis (difference in the concentration and summation toxins) • Effect characteristics of selected matters/matter groups such as solvents, environmental contaminants, metals or pesticides • Combination effects • Risk assessment through specified limit values such as MAK, BLW and BAT values		
Form(s) of instruction	• Lecture		
Total workload in hours	60 hours	Credit points: 2 ECTS credits	

Module composition/Workload in hours		A Course		B Autonomous work	C Final module examination incl. preparation	Total
		a Contact	b Prepara-			

		hours	tion/revision			
	Lecture: Legal studies	11	10		9	30
	Lecture: Toxicology	11	10		9	30
	Total	22	20		18	**60**
Examination requirements	None					
Form(s) of examination and contribution to final mark **Module retake examination**	Written examination (120 minutes) Written examination: 100% Written or oral examination					
Frequency, duration	Winter semester; 1 semester					
Intake capacity	120					
Language of instruction	German					

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BP 06	**Experimental Physics IV: Solid State Physics**	**4th semester**	**6 CP**

Module description	Experimental Physics IV: Solid State Physics
Module code	MatWiss-BP 06
Faculty/Subject/Department	Faculty 07/Physics
Associated degree course(s)/Semester taken	BSc Physics, BSc Advanced Materials
Module coordinator	Cf. German Version
Prerequisites	Experimental Physics I, Experimental Physics II, Experimental Physics III
Learning outcomes	Students shall: • be familiar with the concepts of solid state physics • master typical calculation methods for properties of solids • have experience in the calculation of characteristic properties through practical examples
Module content	Crystal structures, diffractometry with x-rays, neutrons, electrons, bond types, phonons, elastic properties, sound propagation, phononic density of state, Boltzmann statistics, heat capacity, Debye-Weller factor, thermal expansion, Boltzmann transport equation, free electron gas, electronic density of state, Fermi statistics, metal/semi-conductor/insulator, hole concept, Boltzmann transport equation for electrons, measurement of relaxation times, Fermi sphere, de Haas van Alphen effect, cyclotron resonance, electricity transport, ferroelectricity, diamagnetism and paramagnetism, ferromagnetism, semi-conductors, doping, conductivity, Schottky contact, pn-transition, transistors
Form(s) of instruction	• Lecture (2 hours/week) • Tutorial (1 hour/week) • Laboratory (2 hours/week)
Total workload in hours	180 hours — Credit points: 6 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Prepara-tion/revision			
Lecture	30	20			50
Tutorial	15	45		5	65
Laboratory	30	25		10	65
Total	90	90		15	**180**

Examination requirements	50% of tutorial problems must be successfully solved, all laboratory protocols accepted for submission.
Form(s) of examination and contribution to final mark	Written or oral examination on topics covered in lecture and laboratory Tutorial exercises Laboratory protocols Written or oral examination on topics covered in lecture and laboratory: 50% Tutorial exercises: 25% Laboratory protocols: 25%
Module retake examination	Written or oral examination
Frequency, duration	Annually, summer semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BP 05	**Data Acquisition and Processing**	**4th semester**	**7 CP**

Module description	Data Acquisition and Processing
Module code	MatWiss-BP 05
Faculty/Subject/Department	Faculty 07/Physics
Associated degree course(s)/Semester taken	BSc Physics, BSc Advanced Materials
Module coordinator	Cf. German Version
Prerequisites	Experimental Physics I, Experimental Physics II
Learning outcomes	Students shall: • have fundamental knowledge of analogue and digital measurement technology • master the measurement chain (with sensor equipment) from signal acquisition to signal processing to data visualisation • master the use of computer hardware and software for specific measurement technology functions • learn the use of important databases for matter research and be able to utilise the data exchange in network systems in the context of new types of problem
Module content	<u>Fundamental measurement technology</u> • Analogous measurement technology (measurement bridges, measurement amplifiers) • Fundamentals of sensor technology with different physical mechanisms • Basic circuitry of measurement and control technology for the acquisition of different physical properties (transmitters, measurement of frequency and impulse width, closed loops) • Methods for reduction of noise (filter and correlation methods, lock-in measurement technology) • Set-up of measurement technology (AD/DA converter, interfaces, data conversion and storage systems) <u>Measurement technology for matter research</u> • e.g. impedance spectroscopy • High resolution scanning probe microscopy methods for the characterisation of matter (e.g. atomic force microscopy for surface analysis, use of image processing with digital filter techniques) <u>Computer skills</u> • Programming of a measurement problem (control of equipment) and measurement technology in an experiment using software (e.g. Labview) • Data analysis, visualisation and modelling (e.g. Origin/Mathematic/Maple) • Data exchange and acquisition (databases, Internet)
Form(s) of instruction	• Lecture (2 hours/week) • Seminar (1 hour/week) • Laboratory (3.2 hours/week)
Total workload in hours	210 hours — Credit points: 7 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	30	30			60
Seminar	12	12			24
Laboratory	48	62		16	126
Total	90	104		16	**210**

Examination requirements	Successful participation in seminar, all laboratory reports accepted for submission.
Form(s) of examination and contribution to final mark	Written (2 hours) or oral examination (1 hour) Written or oral examination: 100%
Module retake examination	Written examination

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Frequency, duration	Annually, summer semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BM 04	**Advanced Materials Laboratory I**	**4th semester**	**6 CP**

Module description	Advanced Materials Laboratory I – Preparation of Solids
Module code	MatWiss-BM 04
Faculty/Subject/Department	Faculty 08/Chemistry, Faculty 07/Physics
Associated degree course(s)/Semester taken	BSc Advanced Materials /4th semester
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall: • gain experience in the fundamental chemical and physical preparation techniques for the preparation of solids • master the fundamental methods of material synthesis • be able to characterise the synthesised preparations or model substances and interpret the results
Module content	Synthesis of solids • Solid state reactions, transport reactions • Synthesis from solutions • Gas phase methods
Form(s) of instruction	Seminar (1 hour/week) Laboratory (5 hours/week)
Total workload in hours	180 hours — Credit points: 6 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Prepara-tion/revision			
Seminar	15	15	0	0	30
Laboratory	75	10	65	0	150
Total	90	25	65	0	**180**

Examination requirements	Successful completion of test and practical experiments
Form(s) of examination and contribution to final mark	Form: Laboratory reports Mark: No mark will be given (pass/fail).
Module retake examination	Reports
Frequency, duration	Annually, summer semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BM 02	**Advanced Materials II**	**4th semester**	**6 CP**

Module description	Advanced Materials II
Module code	MatWiss-BM 02
Faculty/Subject/Department	Faculty 07/Physics, Faculty 08/Chemistry
Associated degree course(s)/Semester taken	BSc Advanced Materials /4th semester
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall: • understand the fundamental importance of defects, impurities etc. • gain an overview of the targeted manipulation of material properties • develop an understanding of the thermodynamic treatment of defects • develop fundamental knowledge regarding the failure mechanisms of matter • learn concepts for the description of material combinations
Module content	• Physical description of 0-dimensional, 1-dimensionsal and 2-dimensional structural defects (Burgers vector, etc.) • Stresses in epitaxial matter • Stresses caused by doping • Description of relaxation phenomena • Miscible phase TD • Corrosion/oxidation (e.g. Si/SiO2…) in the wider sense • Grain boundaries, influence on mechanical properties • Nucleation • Fatigue/wear • Defects/irregularities/dynamics of defect formation • Ionic conduction • Functionalisation through control of material composition (lambda probe, etc.)
Form(s) of instruction	• Lecture (3 hours/week) • Tutorial (2 hours/week)
Total workload in hours	150 hours — Credit points: 5 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	45	25	0	0	70
Tutorial	30	30	0	20	80
Total	75	55	0	20	**150**

Examination requirements	None
Form(s) of examination and contribution to final mark	Written examination Written examination: 100%
Module retake examination	Written examination
Frequency, duration	Annually, summer semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BM 06	**Material Categories**	**5th semester**	**4 CP**

Module description	Material Categories
Module code	MatWiss-BM 06
Faculty/Subject/Department	Faculty 07/Physics, Faculty 08/Chemistry
Associated degree course(s)/Semester taken	BSc Advanced Materials /5th semester
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall: • understand the interrelationships between function, structure and properties of different material classes • be familiar with the characteristics and resulting application of the different material classes • gain an overview of natural occurrences and "markets" • be familiarised with the technological aspects of matter machining • be able to describe and categorise different matter in relation to specific advanced matter problems
Module content	• Construction matter • Electrical matter • Magnetic matter • Electrochemically relevant matters • Semi-conductors • Soft matters (Polymers, LCs)
Form(s) of instruction	• Lecture (2 hours/week) • Seminar (1 hour/week)
Total workload in hours	120 hours — Credit points: 4 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	30	10	10	10	60
Seminar	15	15	20	10	60
Total	45	25	30	20	**120**

Examination requirements	None
Form(s) of examination and contribution to final mark	Seminar presentation or oral final examination Seminar presentation or oral final examination: 100%
Module retake examination	Seminar presentation or oral final examination
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BM 07	**Modern Concepts in Advanced Materials**	**5th semester**	**5 CP**

Module description	Modern Concepts in Advanced Materials
Module code	MatWiss-BM 07
Faculty/Subject/Department	Faculty 07/Physics, Faculty 08/Chemistry
Associated degree course(s)/Semester taken	BSc Advanced Materials /5th semester
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall: • be familiarised with current research topics (within JLU and externally) in the field of advanced materials • gain in-depth knowledge of a specific topic through a literature review and present this topic in a seminar presentation
Module content	• Nanomaterials • Current topics in electrochemistry • Soft matter • Surface catalysis • Solar cells • Thin films with special magnetic properties • Epitaxial thin films
Form(s) of instruction	• Seminar (2 hours/week)
Total workload in hours	150 hours — Credit points: 5 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Prepara-tion/revision			
Seminar	30	40	50	30	150
Total	30	40	50	30	**150**

Examination requirements	None
Form(s) of examination and contribution to final mark	Seminar presentation (1 hour) Seminar presentation: 100%
Module retake examination	Seminar presentation
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BM 05	**Advanced Materials Laboratory II**	**5th semester**	**6 CP**
Module description	Advanced Materials Laboratory II - Properties of Materials and their Characterisation		
Module code	MatWiss-BM 05		
Faculty/Subject/Department	Faculty 08/Chemistry, Faculty 07/Physics		
Associated degree course(s)/Semester taken	BSc Advanced Materials /5th semester		
Module coordinator	Cf. German Version		
Prerequisites	None		
Learning outcomes	Students shall have the skills to characterise standard materials within a team: • differentiation between bulk and surface properties • determination of structural, electrical and optical properties • correlation of material properties with material and structural characteristics		
Module content	Experiments on: • Magnetic properties (Hall effect) • Determination of the structure (scanning tunnelling microscopy, SEM, x-ray reflectometry, physisorption) • Electrochemical characterisation (impedance spectroscopy, cyclic voltammetry, solar cells) • Characterisation of semi-conductors (current-voltage characteristics, photoluminescence on semi-conductor "quantum waves") • Material analysis (Auger effect, Rutherford backscattering, simultaneous multi-element analysis), mass spectrometry, IR/Raman spectrometry • Chemical analysis (EPS, ESCA; EDX)		
Form(s) of instruction	• Seminar (0.7 hours/week) • Laboratory (4 hours/week)		
Total workload in hours	180 hours	Credit points: 6 ECTS credits	

Module composition/Workload in hours	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Seminar	20	10	10	10	50
Laboratory	60	30	30	10	130
Total	80	40	40	20	**180**

Examination requirements	All laboratory reports must be accepted for submission.
Form(s) of examination and contribution to final mark **Module retake examination**	Final colloquium (45 minutes) Final colloquium: 100% Final colloquium
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BM 03	**Advanced Materials III**	**5th semester**	**5 CP**

Module description	Advanced Materials III - Structural Characterisation of Materials
Module code	MatWiss-BM 03
Faculty/Subject/Department	Faculty 07/Physics, Faculty 08/Chemistry
Associated degree course(s)/Semester taken	BSc Advanced Materials /4th semester
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall: • master scientific methods for the analysis of atomic near-field and long-range order of matter in theory and application • gain fundamental knowledge of the interrelationship between structure and diffraction data of inorganic bonds • be able to determine the important atomic structural parameters of mainly inorganic compounds/matters from diffraction data (phase analysis, lattice constants, lattice defects, particle size) with computer-aided analysis methods • gain fundamental knowledge of the atomic structure of relevant matters in advanced materials • master the scientific language and terminology of crystallography and diffraction methods
Module content	• Introduction into crystallography and diffraction theory (elastic and inelastic scattering, reciprocal lattice, structure factores, atomic form factors) • Influence of structural and measurement parameters on diffraction data (peak widening, absorption, etc.) • Experimental acquisition of powder diffraction data • Tutorials on crystallography: analysis of data with suitable analysis programmes (X'Pert, Origin, Powdcell), determination of lattice type and constants, lattice defects, calculation of structure factors • Introduction into the characterisation methods for nanostructures • Introduction into complementary methods (EXAFS/XANES, NMR, electron microscopy)
Form(s) of instruction	• Lecture (2 hours/week) • Seminar (0.8 hours/week) • Practical tutorial (2 hours/week)
Total workload in hours	150 hours — Credit points: 5 ECTS credits

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Lecture	30	15	0	10	55
Seminar	12	6	0	17	35
Practical tutorial	30	10	0	20	60
Total	72	31	0	47	**150**

Examination requirements	Successful completion of practical tutorials
Form(s) of examination and contribution to final mark **Module retake examination**	Written examination Written examination: 100% Written examination
Frequency, duration	Annually, winter semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BM 09	**Research Project I**	**6th semester**	**9 CP**

Module description	Research Project I
Module code	MatWiss-BM 09
Faculty/Subject/Department	Faculty 07/Physics, Faculty 08/Chemistry
Associated degree course(s)/Semester taken	BSc Advanced Materials
Module coordinator	Cf. German Version
Prerequisites	None
Learning outcomes	Students shall complete a project and thereby: • gain experience in the methods within one specific discipline and deepen their knowledge and skills in this discipline through teamwork • broaden their skills in reviewing literature and in scientific discussion • deepen their skills in the use of multimedia presentation techniques, including didactic aspects
Module content	• Literature review • Experience with modern equipment for the synthesis and characterisation of matter • Implementing a project plan • Discussion and presentation of results • Draft weekly progress reports and a final report
Form(s) of instruction	Participation in a current research and development project for a duration of 5 weeks in an external institution (industry or research centre); alternatively, in consultation with the module coordinator, participation in departmental research with which the degree course is associated. A faculty member monitors the progress of the project through weekly progress reports. • Discussion of work programme (0.5 hours/week) • Discussion of weekly reports (0.5 hours/week) • Final discussion (0.5 hours/week)
Total workload in hours	30 hours — Credit points: 9 ECTS credit

Module composition/Workload in hours

	A Course		B Autonomous work	C Final module examination incl. preparation	Total
	a Contact hours	b Preparation/revision			
Placement	190	40	20	20	270
Total	190	40	20	20	**270**

Examination requirements	None
Form(s) of examination and contribution to final mark	Written final report Oral presentation (30 minutes) Written final report: 70% Oral presentation: 30%
Module retake examination	Written final report Oral presentation (30 minutes)
Frequency, duration	Annually, summer semester; 1 semester
Intake capacity	Calculated according to expected number of students
Language of instruction	German

Module guidance and literature: see notice board / **Date**: see course catalogue

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MatWiss-BM 08	**Advanced Materials IV**			**6th semester**		**3 CP**
Module description	Advanced Materials IV - Advanced Materials in Practice					
Module code	MatWiss-BM 08					
Faculty/Subject/Department	Faculty 07/Physics, Faculty 08/Chemistry					
Associated degree course(s)/Semester taken	BSc Advanced Materials /6th semester					
Module coordinator	Cf. German Version					
Prerequisites	MatWiss BM 01-03					
Learning outcomes	Students shall: • master the fundamental concepts and methods of technical physics • be familiarised with material production, machining and processing technologies • be able to assess advantages and disadvantages as well as costs of individual processes • be able to assess the application possibilities of technologies and processes in an industrial environment					
Module content	• Macroscopic material properties • Vacuum technology • Heating and refrigeration technology • Material processing methods					
Form(s) of instruction	• Seminar (2 hours/week)					
Total workload in hours	90 hours			Credit points: 3 ECTS credits		
Module composition/Workload in hours		A Course		B Autonomous work	C Final module examination incl. preparation	Total
		a Contact hours	b Prepara-tion/revision			
	Seminar	15	15	0	5	35
	Practical tutorial	30	0	0	25	55
	Total	45	15	0	30	**90**
Examination requirements	None					
Form(s) of examination and contribution to final mark **Module retake examination**	Written examination Presentation Written examination: 50% Presentation: 50% Written examination and presentation					
Frequency, duration	Annually, summer semester; 1 semester					
Intake capacity	Calculated according to expected number of students					
Language of instruction	German					

Module guidance and literature: see notice board / **Date**: see course catalogue

MatWiss-BM 10	**Bachelor's Thesis**			**6th semester**	**12 CP**
Module description	Bachelor's Thesis				
Module code	MatWiss-BM 10				
Faculty/Subject/Department	Faculty 07/Physics, Faculty 08/Chemistry				
Associated degree course(s)/Semester taken	BSc Advanced Materials /6th semester				
Module coordinator	Cf. German Version				
Prerequisites	Successful completion of the compulsory modules in the 1st – 5th semesters				
Learning outcomes	Students should possess the skills to apply scientific methods to the development and characterisation of novel materials within the framework of a scientific experiment. Students should be able to present their results in a scientific paper and defend their findings. The dissertation can be an extension of the study project and come out of experiments conducted while working at a commercial lab.				
Module content	• Drafting of a work plan • Familiarisation with relevant literature • Familiarisation with measurement and analysis methods, undertaking and analysis of experiments, discussion of results • Writing the dissertation				
Form(s) of instruction	• All-day instruction on scientific work within a research team				
Total workload in hours	360 hours			Credit points: 12 ECTS credits	
Module composition/Workload in hours		A Course		B Autonomous work	C Final module examination incl. preparation	Total
		a Contact hours	b Preparation/revision			
	Laboratory	280			80	360
	Total	280			80	**360**
Examination requirements	None					
Form(s) of examination and contribution to final mark	Written final report (dissertation) Oral presentation (30 minutes) Written final report (dissertation): 70% Oral presentation (30 minutes): 30%					
Module retake examination	If the dissertation is not passed, a new dissertation must be submitted according to § 34 para. 2 sentence 2 of the General Regulations.					
Frequency, duration	Annually, summer semester; 1 semester					
Intake capacity	Calculated according to expected number of students					
Language of instruction	German					

Module guidance and literature: see notice board / **Date**: see course catalogue