Modulhandbuch

Engineering Physics - Bachelor's Programme

im Summer semester 2024

erstellt am 27/04/24

Basismodule

phy509 - Mechanics

Module label	Mechanics
Modulkürzel	phy509
Credit points	6.0 KP
Workload	180 h (Attendance: 84 hrs Self study: 96 hrs)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Basismodule
Zuständige Personen	• Kittel, Achim (Prüfungsberechtigt) • Kühn, Martin (Prüfungsberechtigt) • Lienau, Christoph (Prüfungsberechtigt) • Nilius, Niklas (Prüfungsberechtigt) • Peinke, Joachim (Prüfungsberechtigt) • Schäfer, Sascha (Prüfungsberechtigt) • Uppenkamp, Stefan (Prüfungsberechtigt) • Wollenhaupt, Matthias (Prüfungsberechtigt) • Kühn, Martin (module responsibility)
Prerequisites	Basic knowledge of mathematics acc. the pre-course of mathematics
Skills to be acquired in this module	Introduction into scientific reasoning; understanding the basic physical principles that govern physical behaviour in the real world, application of these principles to solve practical problems. General introduction to the fundamentals of experimental mechanics.
Module contents	• Scientific reasoning • Space and Time • Kinematics • Dynamics • Motion in accelerated frames • Work and Energy • Laws of Conservation • Physics of rigid bodies • Deformable bodies and fluid media • Oscillations • Waves
Literaturempfehlungen	D. Halliday, R. Resnick, J. Walker, S. W. Koch: Fundamentals of physics / Physik. Wiley-VCH, Weinheim, 2003 P. A. Tipler, G. Mosca, D. Pelte, M. Basler: Physics/Physik. Spektrum Akademischer Verlag, 2004 W. Demtröder: Experimentalphysik, Band 1: Mechanik und Wärme. Springer, Berlin, 2004 L. Bergmann, C. Schäfer, H. Gobrecht: Lehrbuch der Experimentalphysik, Band 1: Mechanik, Relativität, Wärme. De Gruyter, Berlin, 1998
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		weekly exercises, 2 hrs written exam or 45 min oral exam and assignment. Here you will find information about the consideration of bonus points for module marks.

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	WiSe	28

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Exercises		2	WiSe	28
Präsenzzeit Modul insgesamt				56 h

phy513 - Basic Laboratory

Module label	Basic Laboratory
Modulkürzel	phy513
Credit points	9.0 KP
Workload	270 h (270 h (Präsenzzeit 140h, Selbststudium: 130h))
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Basismodule
Zuständige Personen	• Krüger, Michael (module responsibility) • Koch, Sandra (module responsibility) • Huke, Philipp (Prüfungsberechtigt) • Hölling, Michael (Prüfungsberechtigt) • Koch, Sandra (Prüfungsberechtigt) • Krüger, Michael (Prüfungsberechtigt) • Neu, Walter (Prüfungsberechtigt) • Reck, Martin (Prüfungsberechtigt) • Schellenberg, Markus (Prüfungsberechtigt) • Schüning, Thomas (Prüfungsberechtigt) • Silies, Martin (Prüfungsberechtigt) • Teubner, Ulrich (Prüfungsberechtigt)
Prerequisites	- Simultaneous hearing of Mechanics & Electrodynamics and Optics lectures - Course I is a prerequisite for course II
Skills to be acquired in this module	Students will learn the basics of physical experimentation, the use of modern instrumentation, data collection and analysis using appropriate hardware and software. They deepen lecture material through their own experiments. They acquire the skills for planning, implementation, evaluation, analysis, and reporting of physical experiments and presenting of results using multimedia tools. By working in groups, they gain competencies in the areas of teamwork and communication.
Module contents	Introduction to software for scientific data analysis, analysis and assessment of measurement uncertainties, analysis and verification of measured data, fitting of functions to measured data, dealing with modern measurement techniques, carrying out experiments in the fields of mechanics, electricity, optics, nuclear radiation, electronics, signal acquisition, signal processing.
Literaturempfehlungen	See http://www.physik.uni-oldenburg.de/Docs/praktika/45394.html for the first semester and will be provided via Stud-IP for the second semester.
Links	
Language of instruction	English
Duration (semesters)	2 Semester
Module frequency	jährlich
Module capacity	unlimited
Reference text	The first part will take place in Oldenburg (Winter Semester) The second part will take place in Emden (Summer Semester)

Examination	Prüfungszeiten	Type of examination
Final exam of module		Successful execution and record keeping of the experiments, presentation of the results in lectures.

Lehrveranstaltungsform	Practical training
SWS	8
Frequency	
Workload Präsenzzeit	112 h

phy520 - Electrodynamics and Optics

Module label	Electrodynamics and Optics
Modulkürzel	phy520
Credit points	9.0 KP
Workload	270 h (Attendance 112 hrs Self study: 158 hrs)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Basismodule
Zuständige Personen	• Groß, Petra (Prüfungsberechtigt) • Kittel, Achim (Prüfungsberechtigt) • Lienau, Christoph (Prüfungsberechtigt) • Nilius, Niklas (Prüfungsberechtigt) • Peinke, Joachim (Prüfungsberechtigt) • Schäfer, Sascha (Prüfungsberechtigt) • Schellenberg, Markus (Prüfungsberechtigt) • Uppenkamp, Stefan (Prüfungsberechtigt) • van de Par, Steven (Prüfungsberechtigt) • Wollenhaupt, Matthias (Prüfungsberechtigt) • Silies, Martin (Prüfungsberechtigt) • van de Par, Steven (module responsibility)
Prerequisites	Mechanics
Skills to be acquired in this module	Electrodynamics and optics: Students will be able to understand the electric and magnetic phenomena and their treatment by an electromagnetic field including electromagnetic waves - with special emphasis on light. Optical systems: The students should be able with the help of optics basics to apply the optics to solve questions of informatics and measurement technology illumination technology materials processing with laser beams and the development of optical mechanical instruments and systems to implement the field of optics and to solve engineering questions.
Module contents	Electrodynamics and optics: Basics of Electrostatics, matter in an electric field, the magnetic field, motion of charges in electric and magnetic fields, magnetism in matter, induction, electromagnetic waves, light as electromagnetic wave Optical systems: Summary of optical basics, technical optics as basics, optical rays, behaviour and properties of electromagnetic waves, application of wave optic properties, area of validity and low of geometric optics, application of ray optic laws, optical image, imaging construction elements, ray bundle, bundle limitation, physics of rays and light, colours, optical systems, set-up and function of selected optical systems of the illumination technology, measurement technology, material processing with laser beams, Communication technology
Literaturempfehlungen	Electrodynamics and optics: D. Meschede: Gerthsen, Physik. Springer, Berlin, 2005 (available in English) P. A. Tipler, G. Mosca, D. Pelte, M. Basler: Physik. Spektrum Akademischer Verlag, 2004 W. Demtröder: Experimentalphysik, Band 2: Elektrizität und Optik. Springer, Berlin, 2004 (available in English) H. Hänsel, W. Neumann: Physik. Elektrizität, Optik, Raum und Zeit. Spektrum Akademischer Verlag, Heidelberg, 2003 S. Brandt, H. D. Dahmen: Elektrodynamik. Eine Einführung in Experiment und Theorie. Springer, Berlin, 2005 W. Greiner: Klassische Elektrodynamik. Harri Deutsch, Frankfurt, 2002 E. Hecht: Optik. Oldenbourg, München, 2005 Optical systems: Waren J. Smith: Modern Optical Engineering, Mc Graw Hill, 4th edition, 2008 G. Schröder: Technische Optik, Vogel Verlag Würzburg, 2007 Scriptum
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	jährlich

Module capacity			unlimited		
Examination		Prüfungszeiten		Type of examination	
Final exam of module				2 exams: 180 min written exam or 60 min oral exam. Here , you will find information about the consideration of bonus points for module marks.	
Lehrveranstaltungsform	Comment		SWS	Frequency	Workload of compulsory attendance
Lecture			6	SoSe	84
Exercises			2	SoSe	28
Präsenzzeit Modul insgesamt					112 h

phy540 - Mathematical Methods for Physics and Engineering I

Module label	Mathematical Methods for Physics and Engineering I
Modulkürzel	phy540
Credit points	9.0 KP
Workload	270 h (Präsenzzeit: 84 Stunden Selbststudium: 186 Stunden)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Basismodule • Bachelor's Programme Physics, Engineering and Medicine (Bachelor) > Basismodule
Zuständige Personen	• Uppenkamp, Stefan (module responsibility) • Doclo, Simon (Prüfungsberechtigt) • Hohmann, Volker (Prüfungsberechtigt) • Uppenkamp, Stefan (Prüfungsberechtigt) • van de Par, Steven (Prüfungsberechtigt)
Prerequisites	Abiturwissen Mathematik
Skills to be acquired in this module	To obtain basic knowledge in application of mathematical methods to solve problems in physics and engineering
Module contents	Vector algebra (vectors in 2- and 3-space, vector products, planes, lines, cylindrical and spherical coordinates) Preliminary calculus (elementary functions, limits, series, differentiation, integration) Preliminary complex analysis Introduction to ordinary differential equations Partial differentiation Vector calculus (scalar and vector fields, vector operators, line, surface and volume integrals, divergence and Stokes' theorem)
Literaturempfehlungen	K. F. Riley, M. P. Hobson, S. J. Bence: Mathematical methods for physics and engineering. Third edition, 2006
Links	
Languages of instruction	English , German
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		Max. 180 min written exam or 30 min oral exam. Here , you will find information about the consideration of bonus points for module marks.

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		4		56
Exercises		2		28
Präsenzzeit Modul insgesamt				84 h

Aufbaumodule

phy031 - Atomic and Molecular Physics

Module label	Atomic and Molecular Physics
Modulkürzel	phy031
Credit points	6.0 KP
Workload	180 h (Präsenzzeit 84h, Selbststudium: 96h)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Neu, Walter (module responsibility) • Bayer, Tim-Daniel (Prüfungsberechtigt) • Englert, Lars (Prüfungsberechtigt) • Groß, Petra (Prüfungsberechtigt) • Kittel, Achim (Prüfungsberechtigt) • Schäfer, Sascha (Prüfungsberechtigt) • Lienau, Christoph (Prüfungsberechtigt) • Neu, Walter (Prüfungsberechtigt) • Nilius, Niklas (Prüfungsberechtigt) • Pengel, Dominik (Prüfungsberechtigt) • Wollenhaupt, Matthias (Prüfungsberechtigt) • Silies, Martin (Prüfungsberechtigt)
Prerequisites	Courses in Experimental Physics I and II and Mathematics I & II
Skills to be acquired in this module	The students are competent on the fundamental principles of atomic and molecular physics. They are familiar to classical description and have established a quantum mechanical understanding. The exercises and tutorials deepen the knowledge by assigning appropriate homework.
Module contents	• concepts of atomic models • angular momentum, spin, and magnetic properties of the electrons • interaction with electric and magnetic fields • wave-particle dualism of electrons and photons • introduction to quantum mechanics: wave packets, Schrodinger equation, Heisenberg uncertainty principle • relativity and Dirac equation • coupling schemes and atomic spectra • Bosons and fermions • periodic system of the elements • introduction to molecular physics • molecular spectra • applications: the electron in the box, the harmonic oscillator, the hydrogen atom, fine and hyperfine structure, line shapes, spectroscopy and modern experimental methods
Literaturempfehlungen	W. Demtröder: Experimentalphysik, Band 3: Atome, Moleküle, Festkörper. Springer, Berlin, 2000. (available in English) H. Haken, H. C.Wolf: Atom- und Quantenphysik. Springer, Berlin 2004. H. Haken, H. C. Wolf: Molekülphysik und Quantenchemie. Springer, Berlin, 2004. (available in English) H.-J. Leisi: Quantenphysik. Springer, Berlin, 2004. G. Otter, R. Honecker: Atome, Moleküle, Kerne. Teubner, Stuttgart, 1998. B. Thaller: Visual Quantum Mechanics – Selected topics with computer generated movies of quantum mechanical phenomena. Springer, Berlin, 2002.
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited
Reference text	

Examination	Prüfungszeiten	Type of examination
Final exam of module		90 - 180 min. written examination (regular) or 30 -

Examination	Prüfungszeiten	Type of examination
		45 min. oral exam (optional). [Here]http://www.uni-oldenburg.de/en/physics/studies/bonus-points , you will find information about the consideration of bonus points for module marks.

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		4		56
Exercises		2		28
Präsenzzeit Modul insgesamt				84 h

phy041 - Thermodynamics and Statistics

Module label	Thermodynamics and Statistics
Modulkürzel	phy041
Credit points	6.0 KP
Workload	180 h (attendance: 84 hrs self study: 96 hrs)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Kittel, Achim (Prüfungsberechtigt) • Lienau, Christoph (Prüfungsberechtigt) • Nilius, Niklas (Prüfungsberechtigt) • Peinke, Joachim (Prüfungsberechtigt) • Schäfer, Sascha (Prüfungsberechtigt) • Wollenhaupt, Matthias (Prüfungsberechtigt)
Prerequisites	courses experimental physics 1, 2, 3
Skills to be acquired in this module	Procurement of fundamental principles of thermodynamics and statistical physics to enable students to understand and analyze formulation of relations for particle ensembles with appropriate magnitudes.
Module contents	I. PHENOMENOLOGICAL THERMODYNAMICS A) Fundamental Concepts Temperature, thermal equilibrium, 0. law, heat, internal energy, work from a system, first law , thermodynamic states and processes, thermodynamic cycles, B) Application of Fundamental Concepts Carnot and Stirling cycle, second law, entropy, Legendre Transform and potential functions (Free Energy, Enthalpy, Gibbs Potential), irreversible processes and change in entropy, C) Open Systems, real Gases, phase transitions II. STATISTICS Isotropic particle distribution in space Diffusion (1-dim) via particle hopping entropy changes with volume alteration energy distribution for distinguishable particles (Boltzmann- and Maxwell-distribution) energy distribution for non-distinguishable Particles (Fermi-Dirac-, and Bose-Einstein-distribution) Black Body Radiator (Plancks law) Saha-Equation
Literaturempfehlungen	M. W. Zemansky, R. H. Dittman: Heat and Thermodynamics. McGraw-Hill, New York, 1997; Van P. Carey: Statistical thermodynamics and microscale thermophysics, Cambridge University Press, Cambridge (UK) 1999; H. B. Callen: Thermodynamics. John Wiley, New York, 1978; C. Kittel, H. Krömer: Physik der Wärme. Oldenbourg, München, 1993; D. K. Kondepudi, I. Prigogine: Modern thermodynamics. John Wiley, New York, 1998;
Links	
Language of instruction	German
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		KL

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		4		56
Exercises		2		28
Präsenzzeit Modul insgesamt				84 h

phy505 - Lab Project I

Module label	Lab Project I
Modulkürzel	phy505
Credit points	9.0 KP
Workload	270 h (Attendance: 70 hrs Self-study: 200 hrs)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Teubner, Ulrich (module responsibility) • Agert, Carsten (Prüfungsberechtigt) • Anemüller, Jörn (Prüfungsberechtigt) • Dietz, Mathias (Prüfungsberechtigt) • Doclo, Simon (Prüfungsberechtigt) • Ewert, Stephan (Prüfungsberechtigt) • Groß, Petra (Prüfungsberechtigt) • Gütay, Levent (Prüfungsberechtigt) • Hartmann, Alexander (Prüfungsberechtigt) • Schäfer, Sascha (Prüfungsberechtigt) • Hein, Andreas (Prüfungsberechtigt) • Held, Esther (Prüfungsberechtigt) • Helms, Olaf (Prüfungsberechtigt) • Hohmann, Volker (Prüfungsberechtigt) • Hölling, Michael (Prüfungsberechtigt) • Huke, Philipp (Prüfungsberechtigt) • Kittel, Achim (Prüfungsberechtigt) • Kühn, Martin (Prüfungsberechtigt) • Koch, Sandra (Prüfungsberechtigt) • Krüger, Michael (Prüfungsberechtigt) • Kollmeier, Birger (Prüfungsberechtigt) • Lienau, Christoph (Prüfungsberechtigt) • Meyer, Bernd (Prüfungsberechtigt) • Neu, Walter (Prüfungsberechtigt) • Nilius, Niklas (Prüfungsberechtigt) • Peinke, Joachim (Prüfungsberechtigt) • Schellenberg, Markus (Prüfungsberechtigt) • Poppe, Björn (Prüfungsberechtigt) • Vogelgesang, Ralf (Prüfungsberechtigt) • Reck, Martin (Prüfungsberechtigt) • Schmidt, Andreas Hermann (Prüfungsberechtigt) • Schüning, Thomas (Prüfungsberechtigt) • Silies, Martin (Prüfungsberechtigt) • Teubner, Ulrich (Prüfungsberechtigt) • Uppenkamp, Stefan (Prüfungsberechtigt) • van de Par, Steven (Prüfungsberechtigt) • Wollenhaupt, Matthias (Prüfungsberechtigt) • Lange, Sven Carsten (Prüfungsberechtigt)
Prerequisites	Lecture "Electronics"
Skills to be acquired in this module	Laboratory: Knowledge and experience about experimental work, managing experimental work and evaluating results. Design Fundamentals: Achieving basic knowledge in reading, understanding and production of technical drawings, getting and overview about the features of CAD-Software, knowing about the basic principles of designing and dimensioning of machine elements.
Module contents	Laboratory: Experiments in the field of electronics and measurement technique Design Fundamentals: Rules and Standards for Technical Drawings, Design Phases: • Functional requirements, performance specifications • Design methodology • Decision processes • Detailing • Manufacturing Drawings • Grouping of parts

	Basic Machine Elements: • Frames • Joints • Bearings • Sealing
Literaturempfehlungen	Laboratory: Specific project descriptions Design Fundamentals: ISO- and EN- Standards, Childs: Mechanical Design, Ulrich/Eppinger: Product Design and Development, Matousek: Engineering Design
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		Report and project presentation; assignment (Design Fundamentals)

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2		28
Practical training		3		42
Präsenzzeit Modul insgesamt				70 h

phy541 - Mathematical Methods for Physics and Engineering II

Module label	Mathematical Methods for Physics and Engineering II
Modulkürzel	phy541
Credit points	6.0 KP
Workload	180 h (attendance: 56 hrs self study: 124 hrs)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule • Bachelor's Programme Physics, Engineering and Medicine (Bachelor) > Basismodule
Zuständige Personen	• Doclo, Simon (module responsibility) • Doclo, Simon (Prüfungsberechtigt) • Hohmann, Volker (Prüfungsberechtigt) • Uppenkamp, Stefan (Prüfungsberechtigt)
Prerequisites	Contents of the lecture “Mathematical Methods for Physics and Engineering I”
Skills to be acquired in this module	To obtain advanced knowledge in application of mathematical methods to solve problems in physics and engineering.
Module contents	• Matrices and vector spaces (linear vector spaces, basis, norm, matrices, matrix operations, determinant, inverse matrix, eigenvalue decomposition) • Quadratic forms • Linear equations (Gauss elimination, least-squares solution) • Functions of multiple variables (stationary points, constrained optimisation using Lagrange multipliers) • Fourier series
Literaturempfehlungen	K. F. Riley, M. P. Hobson, S. J. Bence: Mathematical methods for physics and engineering. Third edition, 2006
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		Max. 180 min written exam or 30 min oral exam. Here , you will find information about the consideration of bonus points for module marks.

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2		28
Exercises		2		28
Präsenzzeit Modul insgesamt				56 h

phy542 - Mathematical Methods for Physics and Engineering III

Module label	Mathematical Methods for Physics and Engineering III
Modulkürzel	phy542
Credit points	6.0 KP
Workload	180 h (180h (attendance: 56h; self-study: 124h))
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule • Bachelor's Programme Physics, Engineering and Medicine (Bachelor) > Aufbaumodule
Zuständige Personen	• Hohmann, Volker (module responsibility) • Doclo, Simon (Prüfungsberechtigt) • Hohmann, Volker (Prüfungsberechtigt) • Uppenkamp, Stefan (Prüfungsberechtigt) • van de Par, Steven (Prüfungsberechtigt)
Prerequisites	
Skills to be acquired in this module	To obtain advanced knowledge in application of mathematical methods to solve problems in physics and engineering.
Module contents	• Complex analysis • Partial differential equations • Special functions in physics and engineering • Special integral transform in physics and engineering • Special linear and nonlinear differential equations in physics and engineering • Statistics
Literaturempfehlungen	K. F. Riley, M. P. Hobson, S. J. Bence: Mathematical methods for physics and engineering. Third edition, 2006
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		2 hrs written exam or 45 min oral exam. Here , you will find information about the consideration of bonus points for module marks.

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2		28
Exercises		2		28
Präsenzzeit Modul insgesamt				56 h

phy551 - Quantum Structure of Matter

Module label	Quantum Structure of Matter
Modulkürzel	phy551
Credit points	6.0 KP
Workload	180 h (Attendance: 56 hrs Self study: 124 hrs)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Cocchi, Caterina (module responsibility) • Biehs, Svend-Age (Prüfungsberechtigt) • Cocchi, Caterina (Prüfungsberechtigt) • Lienau, Christoph (Prüfungsberechtigt) • Vogelgesang, Ralf (Prüfungsberechtigt)
Prerequisites	Mechanics, Electrodynamics and Optics, Atomic and Molecular Physics, Mathematical Methods for Physics and Engineering I-III. These courses are mandatory prerequisites.
Skills to be acquired in this module	The students will gain knowledge of the fundamental principles of quantum mechanics and their application to the modelling of the equilibrium structure of different atomic, molecular and solid state material systems. The course will enhance their competence to understand and apply basic theoretical concepts in quantum mechanics. The students will learn how to rationalize quantum effects and wave phenomena in a variety of material systems and will become acquainted with strategies how to explain the equilibrium steady-state structure of different types of matter. The students will also be introduced into the nonequilibrium dynamics of selected quantum systems.
Module contents	The course aims at providing a modern introduction into quantum mechanical foundations of the structure of atomic, molecular and solid state systems. It will bridge the gap between „Atomic and Molecular Physics“ and „Solid State Physics.” The following content will be covered: 1. Introduction into quantum mechanics 2. Quantum theory: techniques and applications 3. Atomic and molecular structure 4. Light-matter interaction 5. Molecular spectroscopy 6. Introduction into quantum dynamics 7. Molecular reaction dynamics 8. Macromolecules and Aggregates 9. Solid State Materials The course will be held at the level of an advanced course in physical chemistry and requires basic knowledge of quantum mechanics as introduced in “Atomic and Molecular Physics”.
Literaturempfehlungen	• P. W. Atkins, J. de Paulo, Physical Chemistry, 9th Edition, W. H. Freeman (2009) • W. Demtröder, Atoms, Molecules and Photons, 2nd Edition, Springer (2010) • W. Demtröder, Molecular Physics, Wiley-VCH (2005) • C. Cohen-Tannoudji, B. Diu, F. Laloe, Quantum Mechanics, Vol. I and II, 1st Edition, Wiley (1991) • N. W. Ashcroft, N. D. Mermin, Solid State Physics, 2nd Edition, Cengage Learning (1976). • S. H. Simon, The Oxford Solid State Basics, Oxford University Press (2013). • S. Haroche, J. M. Raimond, Exploring the Quantum: Atoms, Cavities and Photons, Oxford University Press (2006) • L. Susskind, Quantum Mechanics - The Theoretical Minimum, Basics Books (2014)
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		180 min written exam or 45 min oral exam
Lehrveranstaltungsform	Lecture	
SWS		
Frequency	--	

phy555 - Basic Engineering

Module label	Basic Engineering
Modulkürzel	phy555
Credit points	6.0 KP
Workload	180 h (Attendance: 64 hrs Self study: 116 hrs)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Lange, Sven Carsten (module responsibility) • Schmidt, Florian (Prüfungsberechtigt) • Lange, Sven Carsten (Prüfungsberechtigt)
Prerequisites	Basic Math (Algebra, Derivation, Integration) Basic knowledge in Physics (Mechanics, Thermodynamics, esp. Heat transfer)
Skills to be acquired in this module	Achieving basic knowledge in applied mechanics, especially in statics and elasticity theory. Achieving basic knowledge on how to produce objects with defined geometry and properties in an effective and economic way.
Module contents	Applied Mechanics: • Static equilibrium (mainly 2D) • frame works • friction (Coulomb) • Hooke's law (3D including lateral contraction and thermal expansion) • bending and torsion with planar cross sections • Mohr's theory Production Engineering: • Overview on manufacturing technologies, like • Casting and other primary shaping processes • Plastic deformation processes • Cutting and separating processes • Joining processes • Coating processes • Changing material properties
Literaturempfehlungen	Applied Mechanics: Assmann: Technische Mechanik (in German); Meriam, Kraige: Engineering Mechanics, Beer, Russell, Johnston: Vector Mechanics for Engineers Production Engineering: Groover: Fundamentals of Modern Manufacturing DeGarmo: Materials and Processes in Manufacturing König: Fertigungsverfahren (in German)
Links	
Language of instruction	English
Duration (semesters)	2 Semester
Module frequency	halbjährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		2 exams: 180 min written exam or 60 min oral exam. Here , you will find information about the consideration of bonus points for module marks.

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		4	WiSe	56
Exercises		2	SoSe oder WiSe	28
Präsenzzeit Modul insgesamt				84 h

phy563 - Specialization

Module label	Specialization
Modulkürzel	phy563
Credit points	6.0 KP
Workload	180 h (Attendance: 56 hrs Self study: 124 hrs)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Doclo, Simon (module responsibility) • Kollmeier, Birger (module responsibility) • Kühn, Martin (module responsibility) • Neu, Walter (module responsibility) • Poppe, Björn (module responsibility) • Doclo, Simon (Prüfungsberechtigt) • Huke, Philipp (Prüfungsberechtigt) • Schüning, Thomas (Prüfungsberechtigt) • Koch, Sandra (Prüfungsberechtigt) • Kollmeier, Birger (Prüfungsberechtigt) • Kühn, Martin (Prüfungsberechtigt) • Steinfeld, Gerald (Prüfungsberechtigt) • Neu, Walter (Prüfungsberechtigt) • Poppe, Björn (Prüfungsberechtigt) • Silies, Martin (Prüfungsberechtigt) • Teubner, Ulrich (Prüfungsberechtigt) • Looe, Hui Khee (Prüfungsberechtigt)
Prerequisites	
Skills to be acquired in this module	The students are enabled to establish an overview on principles and applications of engineering physics. The introduction to a specific field of specialization yields a basic knowledge on theoretical and experimental concepts and deepens on selected applications.
Module contents	Specialization Laser and Optics: Introduction to relevant research fields in Laser and Optics. Knowledge of the characteristics of waves, optical radiation, design und function of optical elements and instruments, basic design of photonic systems and optical metrology. Biomedical Physics & Acoustics: Overview of the research fields in Oldenburg related to biomedical physics and acoustics (acoustical signal processing, audiology, biomedical signal processing, neuro-sensory science and systems, medical radiation physics, medical imaging, noise control and vibration) Renewable Energies: Introduction into the areas of renewable energies, with special emphasis on energy conversion and utilization, based on complex physical models. The student will be able to understand the fundamental principles of the field renewable energies.
Literaturempfehlungen	Acc. selected lecture
Links	
Language of instruction	English
Duration (semesters)	2 Semester
Module frequency	halbjährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		Max. 2 hrs written exam or 30 min oral exam. Here you will find information about the consideration of bonus points for module marks. 1 Klausur (max. 180 Min.) oder 1 mündliche Prüfung (max. 45 Min.) oder 1 Hausarbeit (max. 30 Seiten)

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		4		56
Seminar				
Präsenzzeit Modul insgesamt				56 h

phy570 - Electronics

Module label	Electronics
Modulkürzel	phy570
Credit points	6.0 KP
Workload	180 h (Attendance: 70 hrs Self study: 110 hrs)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Haja, Andreas (Prüfungsberechtigt) • Haja, Andreas (module responsibility)
Prerequisites	Basic Lab. I, Math. Methods for Physics and Engineering I
Skills to be acquired in this module	The students acquire basic competences to set-up and analyze digital and analog electronic circuits; furthermore basic knowledge for measurement methods as well as for handling measurement systems are imparted
Module contents	logic functions and gates, digital circuit analysis and synthesis, flip-flops, digital counters and memories, A/D- and D/A converters, programmable logic devices , impedances, inductances and capacitances, complex alternating electric quantities, RCL-filter circuits, semiconductor circuits, rectifier circuits, operational amplifier circuits
Literaturempfehlungen	Excerpts from lecture script Weddigen, Jüngst: Elektronik, Springer Verlag Böhmer: Elemente der angewandten Elektronik, Vieweg Verlag Hering, Bressler, Gutekunst: Elektronik für Ingenieure und Naturwissenschaftler, Springer Verlag, 2005 Hill: The Art of Electronics, Cambridge University Press, 1989
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		2 hrs written examination

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		4		56
Exercises		1		14
Präsenzzeit Modul insgesamt				70 h

phy581 - Materials Sciences

Module label	Materials Sciences
Modulkürzel	phy581
Credit points	6.0 KP
Workload	180 h (Attendance: 56 hrs Self study: 124 hrs)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Held, Esther (module responsibility) • Held, Esther (Prüfungsberechtigt) • Helms, Olaf (Prüfungsberechtigt) • Lünemann, Martin (Prüfungsberechtigt) • Schüning, Thomas (Prüfungsberechtigt)
Prerequisites	
Skills to be acquired in this module	The students are able - outgoing from the microscopic structure of engineering materials - to understand its macroscopic properties, so that they are able to involve the behaviour of engineering materials into engineering requirements independently.
Module contents	Introduction Classification of engineering materials in groups Constitution of engineering materials (microscopic structure, macroscopic properties) Physical basics of constitution: Constitution of single phase solids (crystals, amorphous materials, real materials) Constitution of multi-phase materials Basic diagrams of constitution of binary alloys Crystallisation Diffusion Properties of materials Physical properties Mechanical properties (plastic deformation, crack growth, friction, wear) Groups of materials (metals, ceramics, polymers) Selected materials (iron, aluminium, copper) Testing of materials (an overview of methods)
Literaturempfehlungen	E. Hornbogen: Werkstoffe, Springer Verlag Berlin u. a. W. Bergmann: Werkstofftechnik Teil 1, Grundlagen; Carl Hanser Verlag München Wien Bargel, Schulze: Werkstoffkunde, VDI-Springer W. D. Callister, Jr.: Materials Science and Engineering, An Introduction; John Wiley-VCH Verlag Gmbh Weinheim
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	halbjährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		1 hour written examination or 30 min oral exam

Lehrveranstaltungsform	Lecture
SWS	4
Frequency	
Workload Präsenzzeit	56 h

phy590 - Control Systems

Module label	Control Systems
Modulkürzel	phy590
Credit points	6.0 KP
Workload	180 h (120 h)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Huke, Philipp (Prüfungsberechtigt) • Hein, Andreas (Prüfungsberechtigt) • Huke, Philipp (module responsibility) • Huke, Philipp (Module counselling)
Prerequisites	
Skills to be acquired in this module	Understanding of basic open- and closed-loop control systems. Basic concepts for modelling of systems, design and development of controllers. Description of controller design using differential equations. Understanding the response function of a control-loop and testing the control structure with respect to instabilities. The students will achieve the competence to work into technical realization of controlled systems and to develop approaches for optimization.
Module contents	The module contains: Design procedures for controllers, Basic description of components, development, understanding and working with functional diagrams, simulation and modelling, root locus, stability, controller types, linear control systems with reference- and disturbance response function.
Literaturempfehlungen	Hans-Werner Philippsen - Einstieg in die Regelungstechnik mit Python; *München Carl Hanser Verlag GmbH & Co. KG, 20190805* (OPAC) Karl Johan Åström und Richard M. Murray - Feedback Systems: An Introduction for Scientists and Engineers; *New Jersey: Princeton University Press, 2010* (OPAC) Lutz, H. und Wendt, W.: Taschenbuch der Regelungstechnik Unbehauen; H.: Regelungstechnik I, Klassische Verfahren zur Analyse und Synthese linearer kontinuierlicher Regelsysteme
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	every year
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		30 - 45 minutes oral exam. [Here]http://www.uni-oldenburg.de/en/physics/studies/bonus-points , you will find information about the consideration of bonus points for module marks.

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		4		56
Exercises		1		14
Präsenzzeit Modul insgesamt				70 h

phy501 - Numerical Methods

Module label	Numerical Methods
Modulkürzel	phy501
Credit points	6.0 KP
Workload	180 h (180h (attendance: 56h; self-study: 124h))
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Anemüller, Jörn (Prüfungsberechtigt) • Brand, Thomas (Prüfungsberechtigt) • Dietz, Mathias (Prüfungsberechtigt) • Hartmann, Alexander (Prüfungsberechtigt) • Hohmann, Volker (Prüfungsberechtigt) • Lücke, Jörg (Prüfungsberechtigt) • Meyer, Bernd (Prüfungsberechtigt) • Petrovic, Cornelia (Prüfungsberechtigt) • Hohmann, Volker (module responsibility)
Prerequisites	Course Mathematical Methods II passed with a grade of at least 4.0.
Skills to be acquired in this module	Students acquire theoretical knowledge of basic numerical methods and practical skills to apply these methods to physical problems within all areas of experimental, theoretical and applied physics.
Module contents	Basic concepts of numerical Mathematics are introduced and applied to Physics problems. Topics include: Finite number representation and numerical errors, linear and nonlinear systems of equations, numerical differentiation and integration, function minimization and model fitting, discrete Fourier analysis, ordinary and partial differential equations. The learned numerical methods will be partly implemented (programmed) and applied to basic problems from mechanics, electrodynamics, etc. in the exercises. The problems are chosen so that analytical solutions are available in most cases. In this way, the quality of the numerical methods can be assessed by comparing numerical and analytical solutions. Programming will be done in C or, preferably, in Matlab, which is a powerful package for numerical computing. Matlab offers easy, portable programming, comfortable visualization tools and already implements most of the numerical methods introduced in this course. These built-in functions can be compared to own implementations or used in the exercises in some cases when own implementations are too costly. The tutorials provide basic programming support.
Literaturempfehlungen	1. V. Hohmann: Numerical Methods for Physicists, Universität Oldenburg (lecture script; will be provided with the course material) 2. W. H. Press et al.: Numerical Recipes in C - The Art of Scientific Computing. Cambridge University Press, Cambridge, [BIS]http://www.bis.uni-oldenburg.de/katalogsuche/freitext=press+numerical+recipes+art 3. A. L. Garcia: Numerical Methods for Physics. Prentice Hall, Englewood Cliffs (NJ), [BIS]http://www.bis.uni-oldenburg.de/katalogsuche/freitext=garcia+numerical+methods 4. J. H. Mathews: Numerical Methods for Mathematics, Science and Engineering. Prentice Hall, Englewood Cliffs (NJ), [BIS]http://www.bis.uni-oldenburg.de/katalogsuche/freitext=mathews+numerical+methods+science 5. B.W. Kernighan und D. Ritchie: The C Programming Language. Prentice Hall International, Englewood Cliffs (NJ) (in case Matlab is not used for the course)
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	Annual, summer semester
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination

Examination		Prüfungszeiten	Type of examination	
Final exam of module			Ü	
Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe und WiSe	28
Exercises		2	SoSe und WiSe	28
Präsenzzeit Modul insgesamt				56 h

phy502 - Solid State Physics

Module label	Solid State Physics
Modulkürzel	phy502
Credit points	6.0 KP
Workload	180 h (180 h (Präsenzzeit 84h, Selbststudium: 96h))
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Nilius, Niklas (module responsibility) • Kittel, Achim (Prüfungsberechtigt) • Lienau, Christoph (Prüfungsberechtigt) • Nilius, Niklas (Prüfungsberechtigt) • Schäfer, Sascha (Prüfungsberechtigt) • Wollenhaupt, Matthias (Prüfungsberechtigt)
Prerequisites	Experimental Physics I-IV, Quantum structure of Matter
Skills to be acquired in this module	The students gain comprehensive insights into solid state physics and associated phenomena. They learn how symmetry operations are interconnected with structural parameters of solids. From the chemical interaction between atoms, the binding properties and thermodynamic stability of solids are derived. The oscillatory motion of atoms in simple 1D chain models is extended towards the dynamic response of crystals, while a statistical analysis leads to the concept of heat capacity and heat conductance of solids. The quantum mechanical description of particles in a box is exploited to develop the model of free and quasi-free electrons as well as the band structure of solids. The students are made familiar with the economically relevant fields of semiconductor and low temperature physics as well as magnetism.
Module contents	Crystal structures and symmetries, Bravais lattices, Reciprocal lattice and translational symmetry, Brillouin zone, Binding principles in solids (covalent, ionic, metallic, van-der Waals and hydrogen bonding), Dynamic properties of solids, Phonons, Atomic chain models, Dispersion relation, Specific heat, Heat conductance, Electrons in solids, Model of free and quasi-free electrons, State density, Fermi energy, Electrons in periodic potentials, Bloch theorem, Band model of electrons, Effective mass, Band gap, Occupation numbers, Semiconductors, Doping, Dielectric properties, Magnetic properties, Dia-, para- and ferro magnetism, Superconductivity
Literaturempfehlungen	1. N. W. Ashcroft, N. D. Mermin: Solid State Physics. Sounders College, Philadelphia, 2. Introduction to Solid State Physics | *Kittel*, *Charles* | ISBN: 9780471415268 3. S. Elliott: The Physics and Chemistry of Solids. John Wiley & Sons, West Sussex (UK), 4. H. Ibach, H. Lüth: Festkörperphysik. Springer, Berlin
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module		KL

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Lecture		2	SoSe und WiSe	28
Exercises		2	SoSe und WiSe	28
Präsenzzeit Modul insgesamt				56 h

phy533 - Metrology

Module label	Metrology
Modulkürzel	phy533
Credit points	6.0 KP
Workload	180 h (180 h (Präsenzzeit 56h, Selbststudium: 124h))
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Aufbaumodule
Zuständige Personen	• Meyer, Bernd (module responsibility) • Meyer, Bernd (Module counselling) • Doclo, Simon (Prüfungsberechtigt) • Hohmann, Volker (Prüfungsberechtigt) • Huke, Philipp (Prüfungsberechtigt) • Kittel, Achim (Prüfungsberechtigt) • Kollmeier, Birger (Prüfungsberechtigt) • Meyer, Bernd (Prüfungsberechtigt)
Prerequisites	
Skills to be acquired in this module	The students will learn basic principles of measurement technology and signal processing as well as the application of complex measurement methods to extract the measurement information. They will acquire skills to carry out advanced internships and experimental work in research laboratories. Further, they will develop the competence for analytical thinking in the evaluation of measurement situations, which will enable them to solve measurement problems such as those encountered in different branches of industry (e.g. automotive and semiconductor industries; analytical, pharmaceutical and medical industries).
Module contents	Lecture Measurement Technology: Sensors for measuring different physical quantities (e.g. force, temperature, charge, electric and magnetic fields, energies of particles and radiation), high-resolution measurements of small signals, influence of interfering signals, linearization and reduction of interfering variables through compensation methods, noise reduction, phase-sensitive detector, complex measurement systems such as nuclear magnetic resonance, electron resonance, laser measurement technology (including pump / probe systems), spatially resolved measurement methods such as magnetic resonance tomography, electron and scanning probe microscopy. Lecture Signal Processing: Characterization and processing of measurement signals (linear signal analysis, filtering), characterization and elimination of interferences (empirical statistics, noise in physical systems, correlation analysis, phase-sensitive amplifiers, methods of averaging), signal digitization, digital signal processing Signal processing (including time-variant filtering, complex processing algorithms) Filterung, komplexe Verarbeitungsalgorithmen)
Literaturempfehlungen	SE Physikalische Messtechnik: Elmar Schrüfer, Elektrische Messtechnik: Messung elektrischer und nichtelektrischer Größen. Hanser Fachbuchverlag H.-R. Tränkler, E. Obermeier: Sensortechnik. Springer, Berlin; J. Niebuhr, G. Lindner: Physikalische Messtechnik mit Sensoren. Oldenbourg, München; J. F. Keithley [Ed.]: Low /Level Measurements Handbook. Keithley Instruments Inc; VL Signalverarbeitung: K.-D. Kammeyer, K. Kroschel: Digitale Signalverarbeitung: Filterung und Spektralanalyse mit MATLAB-Übungen. Teubner, Stuttgart;

	J.-R. Ohm, H.D. Lüke: Signalübertragung. Springer, Berlin; B. Kollmeier; Skript zur Signalverarbeitung und Messtechnik
Links	
Language of instruction	English
Duration (semesters)	1 Semester
Module frequency	jährlich
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination
Final exam of module	Max. 90 min. Klausur oder 30 min. mündliche Prüfung (Gewichtung 1/2) und 1 Referat oder 1 Hausarbeit (Gewichtung 1/2)	G

Lehrveranstaltungsform	Comment	SWS	Frequency	Workload of compulsory attendance
Vorlesung und Übung		2	SoSe und WiSe	28
Seminar		2	SoSe und WiSe	28
Präsenzzeit Modul insgesamt				56 h

Abschlussmodul

bam - Bachelor´s Thesis Module

Module label	Bachelor´s Thesis Module
Modulkürzel	bam
Credit points	15.0 KP
Workload	450 h (Attendance: 28 hrs Self study: 422 hrs)
Verwendbarkeit des Moduls	• Bachelor's Programme Engineering Physics (Bachelor) > Abschlussmodul
Zuständige Personen	• Agert, Carsten (Prüfungsberechtigt) • Hein, Andreas (Prüfungsberechtigt) • Biehs, Svend-Age (Prüfungsberechtigt) • Brand, Thomas (Prüfungsberechtigt) • Doclo, Simon (Prüfungsberechtigt) • Ewert, Stephan (Prüfungsberechtigt) • Schädler, Marc René (Prüfungsberechtigt) • Hartmann, Alexander (Prüfungsberechtigt) • Neu, Walter (Prüfungsberechtigt) • Kittel, Achim (Prüfungsberechtigt) • Hohmann, Volker (Prüfungsberechtigt) • Kollmeier, Birger (Prüfungsberechtigt) • Schüning, Thomas (Prüfungsberechtigt) • Kühn, Martin (Prüfungsberechtigt) • Peinke, Joachim (Prüfungsberechtigt) • Lienau, Christoph (Prüfungsberechtigt) • Meyer, Bernd (Prüfungsberechtigt) • Poppe, Björn (Prüfungsberechtigt) • van de Par, Steven (Prüfungsberechtigt) • Nilius, Niklas (Prüfungsberechtigt) • Petrovic, Cornelia (Prüfungsberechtigt) • Teubner, Ulrich (Prüfungsberechtigt) • Uppenkamp, Stefan (Prüfungsberechtigt) • Wollenhaupt, Matthias (Prüfungsberechtigt) • Silies, Martin (Prüfungsberechtigt) • Huke, Philipp (Prüfungsberechtigt)
Prerequisites	
Skills to be acquired in this module	Students will apply their diversified scientific and professional skills to plan, prepare, organize and produce single-handed a research study.
Module contents	The thesis comprises empirical, theoretical or experimental research and development according to the field of specialization
Literaturempfehlungen	as required
Links	
Languages of instruction	German, English
Duration (semesters)	1 Semester
Module frequency	
Module capacity	unlimited

Examination	Prüfungszeiten	Type of examination

Examination	Prüfungszeiten	Type of examination
Final exam of module		G
Lehrveranstaltungsform	Seminar	
Frequency		