Institute for Materials Science

Master Course

Materials Science and Business Administration

Module Catalogue

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As of: March 2022

General Remarks

The responsible examination office for this study course is the one of the Institute for Materials Science. It is located on the east side campus of the University of Kiel.

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www.tf.uni-kiel.de/servicezentrum/en/examination-office-mawi?set_language=en

Modules

A module is the smallest graded unit. It might consist out of multiple courses. This module catalogue defines that each module consists in general out of a lecture and an exercises course. Both courses have the same name and module number. For example, you can find in the univis the courses "mawi-702: Solid State Physics 1" and "mawi-702: Solid State Physics 1 - Exercises".
If other courses are recommending for fulfilling a module, they are named in the row "Courses" in the module description.

Credit Points

All credits points in this module catalogue are calculated basing on 30 hours of work for 1 credit point. For example, if you spend 150 hours of work per semester in a module you will get 5 credits. Attendance and self-organized work at the university will be counted with 10-15 hours for one semester hour (SWS, semester periods per week). A module consisting out of 2 SWS lecture and 1 SWS exercises generates a workload of 45 hours per semester, for example, basing on 15 hours per SWS. In general, all workload is calculated basing on 15 hours per SWS. Other bases are mentioned in brackets after the workload.
In addition to this workload, times for self-studies will be counted in the same manner.
If a module description defines 30 hours of self-studies for preparing a lab-course, you should look for this content for at least 2-3 hours a week during the lecture period.

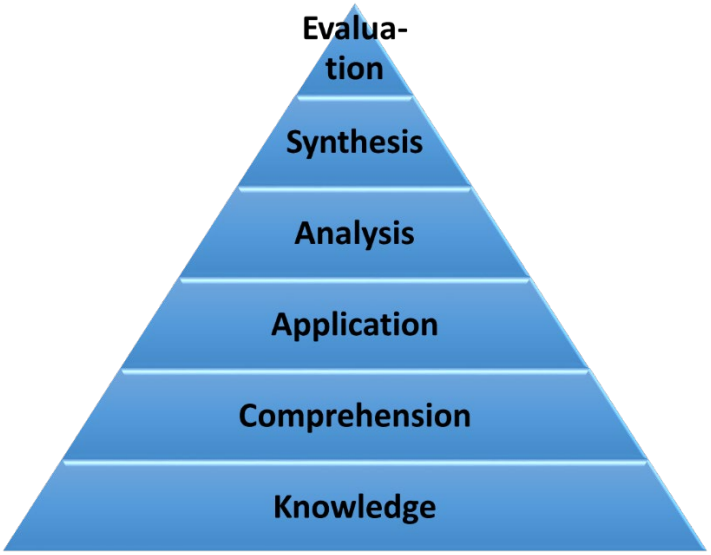
Examinations

For each module, there will be at least one possibility to give the examination within one semester. The title of the examination is the title of the module. In addition, the module- number (mawi-....) can be used for orientation.
In general, all examinations are compulsory and graded. The module-grade is the grade of the examination. Variations are given in the row "Assessment of course achievements", if needed.

All graded module and the grade of the master thesis are counted into the final master-grade weighted by their credit points. The examination regulations for this master course show an example calculation.

Levelling of the learning outcome

The learning outcomes of the modules are defined basing on the „Bloom Taxonomy "
It is levelling the outcomes in six levels:



Each level describes a standard for teaching and working on a topic. From bottom to top the students will deepen and broaden their knowledge, their competences to this knowledge and their experiences to use this in a creative way.
Therefore, topics could be content of different modules several times for increase the level of this topic.

Compulsory Modules of the Master Course

Solid State Physics 1 + 2 5
Analytics 1 8
Advanced Materials A – Metals / Electronic Materials 1 10
Advanced Materials B - Polymers / Electronic Materials 2 14
Advanced Mathematics 18
Thermodynamics and Kinetics 1 22
Master Project 25
Master Thesis 27

Module number	**Mawi 702**			
Module title	**Solid State Physics 1 + 2**			
Module level	Deepening Mathematics, Natural and Engineering Sciences			
Abbreviation	SSP1, SSP2			
Subtitle (if applicable)				
Duration	2 Semesters			
Repetition in academic year	Part 1: Winter Term Part 2: Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. F. Faupel			
Lecturer	Prof. Dr. F. Faupel and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory subject in term 1 and 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ compulsory elective*	*SWS*
	Lecture	Solid State Physics 1	compulsory	2
	Lecture	Solid State Physics 2	compulsory	2
	Practical Exercises	Solid State Physics 1	compulsory	1
	Practical Exercises	Solid State Physics 2	compulsory	1
Workload	60 h lecture 30 h exercise 90 h self-organized studies 60 h revision 240 h total workload			
Credits	8 ECTS			

Prerequisites according to examination order	None			
Recommended prerequisites	Basic in higher mathematics Basics in higher physics			
Course related work	Submission and presentation of exercises			
Examination(s)	Combined written or oral examination on part 1 and 2			
	Title	*Compulsory /Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Solid State Physics 1 + 2	Compulsory	Graded	100%
Learning outcome	The students are familiar with quantum mechanical concepts and can apply these to basic problems in solid state physics. In particular, they have a profound understanding of the types of chemical bonds and how these determine structure and properties. They know important crystal structures and are familiar with the reciprocal lattice and Brillouin zones. They can apply this knowledge to describe lattice vibrations and the interaction of waves with solids. They are familiar with the properties of surfaces and amorphous solids. They know the limitations of the harmonic approximation and can classify properties of solids in terms of phononic and electronic. They know how band structures form in the limit of weak and tight binding and how these can be used to classify materials. They are familiar with the concept of doping of semiconductors. They have a deep understanding of heat conductivity and electrical conductivity and are aware of the underlying similar concepts. They have an advanced understanding of magnetic and dielectric properties. They can perform literature searches related to solid state physics problems and can critically assess the results. They can apply their knowledge to the understanding and tailoring of functional materials.			
Content	*SSP Part 1* • Quantum mechanical mathematical tools • Quantum mechanical axioms and operators • Schrödinger equation • Chemical bondings • Covalent bond • Ionic bond • Van der Waals bond • Hydrogen bond • Metallic bond • Crystal structure • Translational lattice • Symmetry • Simple crystal structures • The effect of defects on physical properties • Noncrystalline solids			

	• Diffraction by solids • Crystalline solids and reciprocal lattice • Structure factor • Diffraction by noncrystalline solids • Experimental methods • Diffraction at surfaces • Dynamics of crystal lattices • Lattice vibrations • Thermal expansion • Thermal conduction by phonons • Phonon spectroscopy *SSP Part 2* • Electrons in solids • Free electron gas and Fermi statistics • Specific heat of metals • Thermionic emission of metals - Energy bands in solids • Approximation of quasi free electrons • Examples of band structures and density of states • Influence of external fields • Effective mass • Hole concept • Electrical conductivity of metals • Thermoelectrical effects • Contact potential • Wiedemann-Franz law • Semiconductors • Intrinsic semiconductors • Doping • Experimental methods to determine electronic properties of semiconductors and metals • Amorphous semiconductors • Magnetic properties • Diamagnetism, paramagnetism, ferro- and antiferromagnetism • Dielectric properties • Dielectric constant and polarizability • Optical properties • Ferroelectric solids • Experimental methods to determine the dielectric function
Media	Blackboard, lecture notes Digital presentation (available in the internet)
Literature	• Ch. Kittel, Introduction to Solid State Physics, John Wiley & Sons, New York 1996 • H. Ibach and H. Lüth, Solid State Physics, Springer, New York 1995 • N.W. Ashcroft, N.D. Mermin, Solid State Physics, Saunders College Publishing, New York 1976

Module number	**Mawi 711**			
Module title	**Analytics 1**			
Module level	Deepening Materials Science			
Abbreviation	Ana1			
Subtitle (if applicable)				
Duration	1 Semesters			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. E. Quandt			
Lecturer	Prof. Dr. E. Quandt and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory subject in term 1			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Analytics 1	compulsory	2
	Practical Exercises	Analytics 1	compulsory	1
Workload	30 h lecture 15 h exercise 45 h self-organized studies 30 h revision 120 h total workload			
Credits	4 ECTS			
Prerequisites according to examination order	None			
Recommended	Basic lecture mathematics			

prerequisites	Basic lecture physics Basic lecture chemistry			
Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Analytics 1	Compulsory	Graded	100%
Learning outcome	The students have a deep understanding of advanced analytical techniques listed below. They know the major methods with their potentials and limitations and they can interpret results in a general way. The Students are particularly capable of assessing what kind of analytical tool or combination of tools can serve his future need while pursuing a career in Materials Science and Engineering.			
Content	• Overview over particle beam- and radiation methods for the analysis of interfaces and thin films • Scanning electron microscopy (SEM) • Transmission electron microscopy (TEM) • Ion backscattering methods			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• J.M. Walls (Ed.): Methods of Surface Analysis; Cambridge University Press 1989 • E. Fuchs, H. Oppolzer, H. Rehme: Particle Beam Microanalysis - Fundamentals, Methods and Applications; VCH 1990 • R. Brundle, C.A. Evans Jr., S. Wilson (Eds.): Encyclopedia of Materials Characterization; Butterworth-Heinemann 1992 • Materials Science and Technology (Eds. R.W. Cahn, P. Haasen, E.J. Kramer): Vol.2 Characterization of Materials VCH 1992			

Module number	**Mawi 705**			
Module title	**Advanced Materials A – Metals / Electronic Materials 1**			
Module level	Deepening Materials Science			
Abbreviation	AMatA			
Subtitle (if applicable)				
Duration	1 Semesters			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. J. McCord			
Lecturer	Prof. Dr. F. Faupel and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory subject in term 1			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory /Compulsory elective*	*SWS*
	Lecture	Advanced Materials A - Metals	compulsory	2
	Lecture	Advanced Materials A - Electronic Materials 1	compulsory	2
	Practical Exercises	Advanced Materials A - Metals	compulsory	1
	Practical Exercises	Advanced Materials A - Electronic Materials 1	compulsory	1
Workload	60 h lecture 30 h exercise 90 h self-organized studies 60 h revision 240 h total workload			
Credits	8 ECTS			

Prerequisites according to examination order	None			
Recommended prerequisites	Basic lecture mathematics Basic lecture physics Basic lecture chemistry			
Course related work	Submission and presentation of exercises			
Examination(s)	Combined examination consisting of a written or oral examination after each part.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Advanced Materials A - Metals	Compulsory	Graded	50%
	Advanced Materials A - Electronic Materials 1	Compulsory	Graded	50%
Learning outcome	The students can compare and contrast the relevant types of bonding for metallic and macromolecular materials, the structural features on all length scales, and the material specific defects. They know the correlation to the mechanical properties and selected functional properties and the revers relation to bonding and microstructure. In this context, they identify and understand the role of defects in determining materials properties. They can use this knowledge to tailor the property profile of engineering metallic and macromolecular materials. They can perform literature searches for solving specific problems and can critically assess the results.			
Content	*Metals* • Alloys • Thermodynamic considerations • Intermetallic phases • Mechanical Properties • Plastic deformation in single crystals via dislocations • Deformation twinning • Deformation of polycrystals • Creep • Fracture • Solid solution hardening • Thermally Activated Processes • Diffusion • Recrystallization • Transformation in the solid state • Particle Hardened Alloys • Ferrous and nonferrous alloys • Electronic and magnetic metals *Electronic Materials* • Conductors • Conduction in metals and alloys			

	• Conductor materials • Ionic conductors and their applications • Superconductivity • Thermoelectricity • Thermal conduction *Dielectric properties and materials (incl. ceramics)* • Theory of dielectrics • Dielectric materials • Polarization mechanisms incl. frequency behaviour • Complex dielectric function • Ferroelectricity and ferroelectric materials • Piezoelectricity and piezoelectricity materials • Pyroelectrical behaviour • Electro-optic materials *Semiconductors* • Fundamentals of semiconductors • Semiconductor processing • Semiconductor devices *Optical properties of materials* • Basic optics • Fresnel equations • Complex index of refraction and optical properties • Applications • Magneto-optics • Lasers and optical modes • Optoelectronics *Magnetic properties of materials* • Fundamentals of magnetism • Ordered magnetism • Hysteresis and domain structure • Magnetic materials and applications
Media	Blackboard, lecture notes Digital presentation (available in the internet)
Literature	• G. Gottstein, Physical Foundations of Materials Science, Springer 2004 (German edition available) • R.E. Reed-Hill and R. Abbaschian, Physical Metallurgy Principles, PWS-Kent 2010 • W.D. Callister, Materials Science and Engineering, Wiley 2000 (or later) • D.R. Askeland, P.P. Fulay & W.J. Wright, The Science and Engineering of Materials, Cengage Learning 2010. • P. Haasen, Physical Metallurgy, Cambridge University Press, Cambridge 1996 (German edition available) • K. Easterling, Modern Physical Metallurgy, Butterworths 1983 • Cottrell, An Introduction to Metallurgy, The Institute of Metals 1995 (reprint at 1975 edition) • N. Stoloff, Physical Metallurgy and Processing, Chapman 1994

	• R.E. Smallman and R.J. Bishop, Modern Physical Metallurgy of Materials Engineering, Butterworth/Heinemann/1999 • R. Cahn und P. Haasen (Eds.), Physical Metallurgy, Elsevier Science 1996 • R.J. Young, P.A. Lovell: Introduction to Polymers, Chapman & Hall 1991. • L.H. Sperling: Introduction to Physical Polymer Science, John Wiley 1992. • U. Eisele: Introduction to Polymer Physics, Springer 1990. • N.G. McCrum, C.P. Buckley, C.B. Bucknall, Principles of Polymer Engineering, Oxford Science Publications 1995. • G. Menges: Werkstoffkunde Kunststoffe, Hanser 1990 (German) • G. W. Ehrenstein: Polymerwerkstoffe, Hanser 1978 (German) • W. Retting, H.M.Laun: Kunststoffphysik, Hanser 1991 (German).

Module number	**Mawi 706**			
Module title	**Advanced Materials B - Polymers / Electronic Materials 2**			
Module level	Deepening Materials Science			
Abbreviation	AMatB			
Subtitle (if applicable)				
Duration	1 Semesters			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. F. Faupel			
Lecturer	Polymers: Prof. Dr. F. Faupel and staff Electronic Materials 2: Prof. Dr. J. McCord and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory /Compulsory elective*	*SWS*
	Lecture	Advanced Materials B - Polymers	compulsory	2
	Lecture	Advanced Materials B - Electronic Materials 2	compulsory	2
	Practical Exercises	Advanced Materials B - Polymers	compulsory	1
	Practical Exercises	Advanced Materials B - Electronic Materials 2	compulsory	1
Workload	60 h lecture 30 h exercise 90 h self-organized studies 60 h revision 240 h total workload			

Credits	8 ECTS
Prerequisites according to examination order	None
Recommended prerequisites	Basics materials science Basics in semiconductors technology Basics in advanced mathematics
Course related work	Submission and presentation of exercises
Examination(s)	Combined examination consisting of a written or oral examination after each part.

Title	*Compulsory /Compulsory elective*	*Graded / Ungraded*	*Weighting*
Advanced Materials B Polymers	Compulsory	Graded	50%
Advanced Materials B - Electronic Materials 2	Compulsory	Graded	50%

Learning outcome	On completion of this module the students understand the physical properties of conductors, semiconductors, dielectric, optical and magnetic materials. The students review the fundamentals of electrical, semiconductor, dielectric, and magnetic devices based on the discussion of the selected functional materials and devices. The students examine technological aspects such as processing of electrical materials. The students will be able to relate the properties of electronic materials to specific applications and will be able to use their knowledge for the selection of the appropriate material and method for engineering problems.
Content	*Polymers* • Properties and Classification of Plastics • Binding Forces and Structure • Polymer Synthesis • Polymers in Melts and Solutions Thermodynamics and chain kinetics • Crystallization and Glass Formation • Mechanical Properties • Dielectric and Optical Properties • Conducting Polymers • Sorption, Diffusion and Permeation • Chemical and Physical Aging, Recycling Plastics technology *Electronic Materials* • Conductors • Conduction in metals and alloys • Conductor materials • Ionic conductors and their applications • Superconductivity • Thermoelectricity

	• Thermal conduction *Dielectric properties and materials (incl. ceramics)* • Theory of dielectrics • Dielectric materials • Polarization mechanisms incl. frequency behaviour • Complex dielectric function • Ferroelectricity and ferroelectric materials • Piezoelectricity and piezoelectricity materials • Pyroelectrical behaviour • Electro-optic materials *Semiconductors* • Fundamentals of semiconductors • Semiconductor processing • Semiconductor devices *Optical properties of materials* • Basic optics • Fresnel equations • Complex index of refraction and optical properties • Applications • Magneto-optics • Lasers and optical modes • Optoelectronics *Magnetic properties of materials* • Fundamentals of magnetism • Ordered magnetism • Hysteresis and domain structure • Magnetic materials and applications
Media	Blackboard, lecture notes Digital presentation (available in the internet)
Literature	• S. Kasap: Principles of Electronic Materials and Devices, McGraw-Hill, New York • R.E. Hummel: Electronic Properties of Materials, Springer, New York • L.A.A. Warnes: Electronic Materials, MacMillan, London • Moulson, A.J., Herbert, J. M.: Electroceramics (Materials, Properties, Applications); Chapman & Hall, London • Kingery, W.D., Bowen, H.K., Uhlmann, D.R.: Introduction to Ceramics, Wiley-Interscience, New York • C. Carter, M. Norton: Ceramic Materials, Springer, New York • Hench, L.L., West, J.K.: Principles of Electronic Ceramics; Wiley-Interscience, New York • S. Kasap: Optoelectronics and Photonics, McGraw-Hill, New York • J.M.D. Coey: Magnetism and Magnetic Materials, Cambridge University Press, Cambridge • G.M. Fasching, Werkstoffe für die Elektrotechnik, Springer, New York

	• Hyperscripte: http://www.tf.uni-kiel.de/matwis/amat/admat_en/index.html http://www.tf.uni-kiel.de/matwis/amat/elmat_en/index.html

Module number	**Mawi 707**			
Module title	**Advanced Mathematics**			
Module level	Deepening Mathematics, Natural and Engineering Sciences			
Abbreviation	AMath, CompMath			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible Institute	Institute for Materials Science			
Responsible staff member	Dr. J. Carstensen			
Lecturer	Dr. J. Carstensen and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory subject in term 1			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Mathematics for Material Science	compulsory	2
	Practical Exercises	Computational Mathematics	compulsory	2
	Practical Exercises	Mathematics for Material Science	compulsory	1
Workload	30 h lecture 45 h exercise 45 h self-organized studies 60 h revision 180 h total workload			
Credits	6 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Basics in mathematics			
Course related work	• Submission and presentation of exercises • Short summary of team (2 students) work in computational mathematics			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Mathematics for Material Science	Compulsory	Graded	100%
Learning outcome	The students can access a robust "toolbox" containing the listed topics. They have the ability for solving mathematical problems in material science analytically and numerically. They can write programs in Mathlab for visualizing results in 2D and 3D, analyse measured data and solve transcendent equations and differential equations. The students have a reasonable theoretical mathematical background and a basic understanding of numerical algorithms for an efficient use of computers.			
Content	*Mathematics for Material Science* Algebra • Complex numbers • Complex e-function • Other complex functions • Vectors in N-dimensional space • Matrices • Square matrices and determinants • Systems of Linear Equations • Eigenvalues and Eigenvectors • Scalar and vector product • Hermite and unitary matrices with complex components Calculus I: Functions of one Variable • Derivatives and Integrals • Calculation rules of derivatives and integrals • Sequences and Series • Taylor series and their application • Linear Optimization • Fitting to an orthonormal set of functions • Functions as vectors • Schmidt's orthonormalization procedure • Fourier series • Fourier-Transforms • Solution of DEQs by Fourier Transformation • Fourier Series vs. Fourier Transformation • Error function • Gamma function • Delta function			

	Calculus II: Functions of multiple variables • Partial derivatives / Derivatives in certain directions • Total Derivatives • Minimization problems • Simple N-dimensional integrals *Computational Mathematics* General programming • The program Matlab • Variables • Functions • Algorithms • Representation of numbers in computers • Numerical errors Data Visualization • Curves, Histograms, log-scale • 2D • 3D Interpolation • Polynomial interpolation • Cubic spline Finding Zeros • Iterative Methods • Fix Points • Bisectioning • Newton algorithm Numerical Minimization • Linear optimization • Nonlinear optimization • Golden section search • Fitting of data Solving linear systems of equation • Gaußian algorithm • Pivotization Numerical integration • Trapezium rule • Simpson rule • Higher order rules Integration of ordinary differential equations • Euler method • Runge-Kutta method • Stiff sets of differential equations • Implicit algorithms
Media	Blackboard, lecture notes Digital presentation (available in the internet)
Literature	*Mathematics for Material Science* • Script for "Mathematics for Material Science" • Engineering mathematics: a foundation for electronic, electrical, communications and systems engineers, Anthony Croft. - 3. ed. - Harlow, England [u.a.] : Prentice Hall, 2001

	• Basic mathematics for electronic engineers: models and applications, John E. Szymanski. - London : Van Nostrand Reinhold, 1989 • Modern engineering mathematics, Glyn James. - 3rd ed. - Harlow [u.a.] : Prentice Hall, 2001 • Advanced modern engineering mathematics, Glyn James. - 2. ed. - Harlow, England [u.a.] : Addison-Wesley, 1999 *Computational Mathematics* • Script for " Computational Mathematics" • Numerical methods in engineering with MATLAB, Jaan Kiusalaas. - Cambridge [England] : Cambridge University Press, 2005 (auch E-book) • MATLAB for engineers explained, Fredrik Gustafsson. - 2. pr. - London [u.a.] : Springer, 2003 • Getting started with MATLAB 7: a quick introduction for scientists and engineers, Rudra Pratap. - New York [u.a.] : Oxford Univ. Press, 2006 • Numerical recipes in C: the art of scientific computing, William H. Press. - 2. ed.. - Cambridge [u.a.] : Cambridge Univ. Press, 1992

Module number	**Mawi 708**			
Module title	**Thermodynamics and Kinetics 1**			
Module level	Deepening Chemistry, Physics and Engineering Sciences			
Abbreviation	TdK1			
Subtitle (if applicable)	Thermodynamics of classical and quantum mechanical particles			
Duration	1 Semester			
Repetition in academic year	Winter term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Dr. J. Carstensen			
Lecturer	Dr. J. Carstensen and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory subject in term 1			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Thermodynamics and Kinetics 1	compulsory	2
	Practical Exercises	Thermodynamics and Kinetics 1	compulsory	1
Workload	30 h lecture 15 h exercise 45 h exercise (self-organized studies) 30 h lecture (revision) 120 h total workload			
Credits	4 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Basic lecture mathematics Basic lecture physics Basic lecture chemistry			
Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Thermodynamics and Kinetics 1	Compulsory	Graded	100%
Learning outcome	The students have an in-depth understanding of chemical thermodynamics and kinetics for material scientists. The students can deduct the function of model systems, e.g. perfect gas, ideal solution etc. for the calculation of the materials properties. They know how to modify simple models to represent a more realistic point of view, thus enabling the description of real systems. The students have knowledge in practical fields, e.g. how the properties of materials and their technological application are related to their thermodynamic and chemical properties. The students can combine and use their skills in mathematics, physics and chemistry to the interdisciplinary aspects of thermodynamics and kinetics.			
Content	*Thermodynamics and Kinetics 1* • Basic properties of gases • Model of the perfect gas • Models for real gases • The First Law • Theory of state functions • Heat and work • Theory of heat capacity • Enthalpy • Joule- and Joule-Thomson experiment • The Second Law • Heat engines • Entropy and spontaneity of processes • Gibbs- and Helmholtz energies • Thermodynamic potentials and Legendre transformation • Physical transformations of pure substances • Phase rule of Gibbs • Simple phase diagrams (pVT-plots) • Clapeyron's equation and its application to phase diagrams • Ehrenfest classification • Simple mixtures • Ideal vs. real mixture • Entropy of mixing, excess enthalpies			

	• Chemical potential of real systems, fugacity and activity • Partial molar quantities- theory and application • Ideal and ideal dilute solutions • Raoult's, Henry's law and deviations • Activities of solutions, Activity coefficients • Binary phase diagrams, phase separation, fractional distillation • Equilibrium conditions: mass action law • Response of equilibriums to conditions (T, p) • Electrochemical reactions: Nernst-equation
Media	Blackboard, lecture notes Digital presentation (available in the internet)
Literature	• P. Atkins, Physical Chemistry, 8th ed, Oxford 2006 • Balluffi et al. Kinetics of Materials, Wiley 2004 • David R. Gaskell, Introduction to the Thermodynamics of Materials, Taylor & Francis, New York 2003 • H. Weingärtner: Chemische Thermodynamik, Teubner 2003 • B. S. Bokstein, M. I. Mendelev, D. J. Srolovoitz: Thermodynamics & Kinetics in Materials Science, Oxford University Press 2003

Module number	**BWLMProjekt-01a**			
Module title	**Master Project**			
Module level	Deepening in Materials Science and Business Administration Sciences			
Abbreviation	MaPro			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Schultz			
Lecturer	Prof. Dr. C. Schultz and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Project Work	Master Project	compulsory	8
	Seminar	Master Project	compulsory	2
Workload	120 h project work 30 h seminar 150 h self-organized studies 300 h total workload			
Credits	10 ECTS			
Prerequisites according to examination order	Min. 44 credit points			
Recommended prerequisites	Deepened lectures and knowledge in Materials Science and Business Administration			

Course related work	None			
Examination(s)	Presentation and written summery			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Master Project	Compulsory	Graded	100%
Learning outcome	The students know how to combine their knowledge in materials science and in business administration for one aim. They have experience to work as a group on one topic successfully. The students can define the needed steps and milestone for managing a project and know how to reach them efficiently. By group work and presentations, they have improved skills in communication and networking.			
Content	The Master Project treats actual topics of science work of the Institute for Business. The focus concentrates on the combination of business administration and engineering science on these topics. The students have to define a project plan with all needed steps and milestones on the one hand. On the other hand, they have to realize and work out the engineering aspects to this topic. In combination they have to develop a business plan. to this topic and have to define useable tools for managing this one. The topic of the Master Project can be practical as well a theoretical.			
Media	n/a			
Literature	n/a			

Module number	**Mawi 1001**
Module title	**Master Thesis**
Module level	Deepening Mathematics, Natural and Engineering Sciences
Abbreviation	
Subtitle (if applicable)	
Duration	1 Semesters
Repetition in academic year	Summer Term
Responsible faculty	Faculty of Engineering
Responsible institute	Institute for Materials Science
Responsible staff member	Dr. O. Riemenschnieder
Lecturer	Professors of the Institute for Materials Science and the Institute for Business
Teaching language	English
Assignment to the curriculum	Compulsory subject in term 4
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration
Evaluation	Graded
Module courses	*n/a*
Workload	900 h total workload
Credits	30 ECTS
Prerequisites according to examination order	Min. 72 credit points
Recommended prerequisites	All compulsory courses of the study course should be passed. By a selection of elective modules, a deepened understanding in theory and practise of one or more topics should be achieved.
Course related work	None
Examination(s)	Written thesis

Learning outcome	The students have wide and deep experience in individually solving a science problem at the interdisciplinary border between materials science and business administration. They know how to organized themselves for project work in a given time window. They can research the state of the art for a given subject and can define a starting point. They have experiences in solving questions concerning materials science as well as concerning business administration for this subject. The students can discuss their results and thought in a scientific community giving and taking criticism. The students are able to summarize their results in a written thesis.
Content	The Master Thesis is a final work which combines all knowledge and experiences of the study work for solving one new research topic. A thesis is an individual science work following the rules of Good Scientific Practice by the German research Foundation (DFG). It consists out of questioning, analysing, experimenting, evaluating and interpreting practical and theoretical work as well as literature research and publication. The subject of the thesis should by placed at the interdisciplinary border between materials science and business administration.
Media	n/a
Literature	n/a

Technical Compulsory Elective Modules of the Master Course

Analytics 2 30
Master Lab 1 32
Thermodynamics and Kinetics 2 35
Electron Microscopy 43
Micro- and Nanosystem Technology 45
Semiconductors and Defects 48
Smart Materials 51
Thin Films 54
Advanced Metallic Materials 56
Advanced Organic Materials 58
Magnetic Materials: Physics and Applications 62
Chemistry and Physics of Biomaterials 64
Selected Topics in Materials Science 66
Selected Topics in Solid State Chemistry 68
Optical Materials 70
Advanced Topics in Organic Materials 72
Advanced Topics in Metallic Materials 74
Linear Finite Element Methods 76
Selected Topics in Computational Materials Science 78
Computational Modeling of Inelastic Material Behavior 80
Finite Element Methods 82
Synchrotron Techniques for Materials Characterization 84
Advanced Continuum Mechanics 86
(Bio)functionalized Polymers 88
Advanced Energy Materials 90
Data Science for Material Scientists 92
Scientific Writing Online Course 94
Bioinspired Materials and Molecular Modelling 96
Biosensor Technologies 99

Module number	**Mawi 805**			
Module title	**Analytics 2**			
Module level	Deepening Materials Science			
Abbreviation	Ana2			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. E. Quandt			
Lecturer	Prof. Dr. E. Quandt and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Analytics 2	compulsory	2
	Practical Exercises	Analytics 2	compulsory	1
Workload	30 h lecture 15 h exercise 45 h self-organized studies 30 h revision 120 h total workload			
Credits	4 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Basic lecture mathematics Basic lecture physics Basic lecture chemistry			
Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Analytics 2	Compulsory	Graded	100%
Learning outcome	The students have a deep understanding of advanced analytical techniques as listed below. They know the major methods with their potentials and limitations and they can interpret results in a general way. The Students are particularly capable of assessing what kind of analytical tool or combination of tools can serve his future need while pursuing a career in Materials Science and Engineering.			
Content	• Secondary ion mass spectroscopy • Overview over methods for analysis of surfaces and interfaces • Electron emission spectroscopy methods • Scanning probe microscopy • X-ray methods			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• J.M. Walls (Ed.): Methods of Surface Analysis; Cambridge University Press 1989 • E. Fuchs, H. Oppolzer, H. Rehme: Particle Beam Microanalysis - Fundamentals, Methods and Applications; VCH 1990 • R. Brundle, C.A. Evans Jr., S. Wilson (Eds.): Encyclopedia of Materials Characterization; Butterworth-Heinemann 1992 • Materials Science and Technology (Eds. R.W. Cahn, P. Haasen, E.J. Kramer): Vol.2 Characterization of Materials VCH 1992			

Module number	**Mawi 709**			
Module title	**Master Lab 1**			
Module level	Deepening Materials Science			
Abbreviation	MLC1			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter and summer term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Dr. O. Riemenschneider			
Lecturer	Dr. O. Riemenschneider and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 1,2 or 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	ungraded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lab course	Master Lab 1	compulsory	3
Workload	24 h lab course (8 experiments) 16 h preparation time (self-organized studies) 80 h lab report writing (revision) 120 h total workload			
Credits	4 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	Knowledge of basics obtained during bachelors course			
Course related work	None			

<table>
<tr><td rowspan="3">Examination(s)</td><td colspan="4">8 certificates including colloquium, experimentation and report</td></tr>
<tr><td>Title</td><td>Compulsory / Compulsory elective</td><td>Graded / Ungraded</td><td>Weighting</td></tr>
<tr><td>Master Lab 1</td><td>Compulsory</td><td>Ungraded</td><td>100%</td></tr>
<tr><td>Learning outcome</td><td colspan="4">The students have experiences in practical working in a modern science lab.
Depending on their selection they know the most important preparative (P) or analytic (A) tools for solid materials and how to use them. (The learning outcome of the module consist of the selection of the experiments and their specific learning outcomes.)
They have realized the need and importance of safe lab working and acquired the ability to provide rules and equipment for this.
The students can work safe and effective under lab conditions
They work in a team and know how to arrange tasks and time.
The students are able to document their work in an appropriate way and can summarize their results in intelligible and precise lab reports.</td></tr>
<tr><td>Content</td><td colspan="4">Hands-on experiments on selected topics in Materials Science and Engineering and related fields. (P -) indicates preparative and (A -) analytic tools and the specific learning outcome.

8 experiments out of the following list without repetition in module mawi-709, mawi-804 and mawi-938:

• M101 Evaporation Methods (P – knowledge of and experiences in evaporation deposition)
• M102 Spin Coating (P – knowledge of and experiences in thin film deposition by means of spin coating)
• M103 Nanostructuring of Copper surfaces (P – knowledge of properties nanostructured surfaces and experiences of their preparation)
• M104 Etching of Semiconductors (P – knowledge of and experiences in etching of semiconductors)
• M105 Micro Electromechanical Systems (P – knowledge of and experiences in lithography processes needed to process MEMS)
• M106 Vibrating Sample Magnetometry (A – knowledge of and experiences in magnetic characterization of ferromagnetic samples)
• M107 Chemical Solution Deposition of Lead Zirconate Titanate Thin Films (P/A – knowledge of piezo electric materials and experiences in their preparation)
• M108 Atomic Force Microscopy (A – knowledge of and experiences in studying surface morphology)
• M109 Scanning Electron Microscopy (A - knowledge of and experiences in studying bulk morphology)
• M110 Differential Thermal Analysis (A - knowledge of and experiences in thermal analysis of materials)</td></tr>
</table>

	• M111 Biocompatibility Tests of Materials (P/A - knowledge of and experiences in testing the biocompatibility of materials) • M112 Scanning Tunnel Microscopy (A - knowledge of and experiences in contact free studying surface morphology) • M202 Sorption and Diffusion in Membranes (P - knowledge of and experiences in thermal gravimetric analysis) • M203 Photocatalysis (A - knowledge of and experiences in characterizing photo catalysis) • M205 Magnetostrictive Materials (P/A - knowledge of and experiences in characterizing of magneto restrictive materials) • M206 Tunnelling Magneto Resistance (A - knowledge of and experiences in characterizing magento resistance) • M208 Impedance Spectroscopy (A - knowledge of and experiences in impedance spectroscopy) • M209 MOKE Microscopy (A - knowledge of and experiences in characterizing materials by means of magneto-optical kerr effect) • M210 X-ray Photoelectron Spectroscopy (A - knowledge of and experiences in chemical characterizing of a surface) • M211 Dynamical-Mechanical Analysis of Polymers (A - knowledge of and experiences in characterizing mechanical properties of solid materials) • M213 Shape Memory Alloys (A - knowledge of and experiences in characterizing mechanical properties of shape memory alloys) • M214 Delta-E-Effect Sensor (A - knowledge of and experiences in delta-E-sensors and their characteristics) • M215 Composition Analysis of Heterostructure Lasers (A - knowledge of and experiences in characterizing materials by means of TEM)
Media	Transmission and measurement equipment
Literature	Manuals are available for all experiments at www.tf.uni-kiel.de/servicezentrum/en/materials-sciencs-lab-courses. They contain individual literature references for all experiments.

Module number	**Mawi 803**			
Module title	**Thermodynamics and Kinetics 2**			
Module level	Deepening Chemistry, Physics and Engineering Sciences			
Abbreviation	TdK2			
Subtitle (if applicable)	Thermodynamics of classical and quantum mechanical particles			
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Dr. J. Carstensen			
Lecturer	Dr. J. Carstensen and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Thermodynamics and Kinetics 2	compulsory	2
	Practical Exercises	Thermodynamics and Kinetics 2	compulsory	1
Workload	30 h lecture 15 h exercise 45 h exercise (self-organized studies) 30 h lecture (revision) 120 h total workload			
Credits	4 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Basic lecture mathematics Basic lecture physics Basic lecture chemistry			
Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Thermodynamics and Kinetics 2	Compulsory	Graded	100%
Learning outcome	The students have knowledge about transport mechanisms and models, the statistical approach for calculating partition functions and thermodynamic potentials. They can combine these to aspects of solid state physics by discussing non-linear dynamics e.g. of a Laser and the relaxation time approximation of the Boltzmann equation. The students can combine and use their skills in mathematics, physics and chemistry to the interdisciplinary aspects of thermodynamics and kinetics.			
Content	• Kinetic model of free classical particles (ideal gas) • Maxwell speed distribution • Simple transport model: mean free path • Non stationary condition: continuity equation • Configuration, weights, and probabilities • Distribution functions • Information and grand canonical ensemble • Fermi-, Bose, Boltzmann-distribution • The free Boson • Description of non-equilibrium: Laser as example • The Boltzmann equation: relaxation time approximation • Solution for free electron gas: ohms law, diffusion, heat transport			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• P. Atkins, Physical Chemistry, 8th ed, Oxford 2006 • Balluffi et al. Kinetics of Materials, Wiley 2004 • David R. Gaskell, Introduction to the Thermodynamics of Materials, Taylor & Francis, New York 2003 • H. Weingärtner: Chemische Thermodynamik, Teubner 2003 • B. S. Bokstein, M. I. Mendelev, D. J. Srolovoitz: Thermodynamics & Kinetics in Materials Science, Oxford University Press 2003			

Module number	**Mawi 804**			
Module title	Master Lab 2			
Module level	Deepening Materials Science			
Abbreviation	MLC2			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Dr. O. Riemenschneider			
Lecturer	Dr. O. Riemenschneider and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 1, 2 or 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	ungraded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lab course	Master Lab 2	compulsory	3
Workload	24 h lab course (8 experiments) 16 h preparation time (self-organized studies) 80 h lab report writing (revision) 120 h total workload			
Credits	4 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	Knowledge of basics obtained during bachelors course			
Course related work	None			

Examination(s)	8 certificates including colloquium, experimentation and report			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Master Lab 2	Compulsory	Ungraded	100%
Learning outcome	The students have experiences in practical working in a modern science lab. Depending on their selection they know the most important preparative (P) or analytic (A) tools for solid materials and how to use them. (The learning outcome of the module consist of the selection of the experiments and their specific learning outcomes.) They have realized the need and importance of safe lab working and acquired the ability to provide rules and equipment for this. The students can work safe and effective under lab conditions They work in a team and know how to arrange tasks and time. The students are able to document their work in an appropriate way and can summarize their results in intelligible and precise lab reports.			
Content	Hands-on experiments on selected topics in Materials Science and Engineering and related fields. (P -) indicates preparative and (A -) analytic tools and the specific learning outcome. 8 experiments out of the following list without repetition in module mawi-709, mawi-804 and mawi-938: • M101 Evaporation Methods (P – knowledge of and experiences in evaporation deposition) • M102 Spin Coating (P – knowledge of and experiences in thin film deposition by means of spin coating) • M103 Nanostructuring of Copper surfaces (P – knowledge of properties nanostructured surfaces and experiences of their preparation) • M104 Etching of Semiconductors (P – knowledge of and experiences in etching of semiconductors) • M105 Micro Electromechanical Systems (P – knowledge of and experiences in lithography processes needed to process MEMS) • M106 Vibrating Sample Magnetometry (A – knowledge of and experiences in magnetic characterization of ferromagnetic samples) • M107 Chemical Solution Deposition of Lead Zirconate Titanate Thin Films (P/A – knowledge of piezo electric materials and experiences in their preparation) • M108 Atomic Force Microscopy (A – knowledge of and experiences in studying surface morphology) • M109 Scanning Electron Microscopy (A - knowledge of and experiences in studying bulk morphology) • M110 Differential Thermal Analysis (A - knowledge of and experiences in thermal analysis of materials) • M111 Biocompatibility Tests of Materials (P/A - knowledge of and experiences in testing the biocompatibility of materials)			

	• M112 Scanning Tunnel Microscopy (A - knowledge of and experiences in contact free studying surface morphology) • M202 Sorption and Diffusion in Membranes (P - knowledge of and experiences in thermal gravimetric analysis) • M203 Photocatalysis (A - knowledge of and experiences in characterizing photo catalysis) • M205 Magnetostrictive Materials (P/A - knowledge of and experiences in characterizing of magneto restrictive materials) • M206 Tunnelling Magneto Resistance (A - knowledge of and experiences in characterizing magento resistance) • M208 Impedance Spectroscopy (A - knowledge of and experiences in impedance spectroscopy) • M209 MOKE Microscopy (A - knowledge of and experiences in characterizing materials by means of magneto-optical kerr effect) • M210 X-ray Photoelectron Spectroscopy (A - knowledge of and experiences in chemical characterizing of a surface) • M211 Dynamical-Mechanical Analysis of Polymers (A - knowledge of and experiences in characterizing mechanical properties of solid materials) • M213 Shape Memory Alloys (A - knowledge of and experiences in characterizing mechanical properties of shape memory alloys) • M214 Delta-E-Effect Sensor (A - knowledge of and experiences in delta-E-sensors and their characteristics) • M215 Composition Analysis of Heterostructure Lasers (A - knowledge of and experiences in characterizing materials by means of TEM)
Media	Transmission and measurement equipment
Literature	Manuals are available for all experiments at www.tf.uni-kiel.de/servicezentrum/en/materials-sciencs-lab-courses. They contain individual literature references for all experiments.

Module number	**Mawi 938**			
Module title	Master Lab 3			
Module level	Deepening Materials Science			
Abbreviation	MLC3			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Dr. O. Riemenschneider			
Lecturer	Dr. O. Riemenschneider and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 1, 2 or 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	ungraded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lab course	Master Lab 3	compulsory	3
Workload	24 h lab course (8 experiments) 16 h preparation time (self-organized studies) 80 h lab report writing (revision) 120 h total workload			
Credits	4 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	Knowledge of basics obtained during bachelors course			
Course related work	None			

Examination(s)	8 certificates including colloquium, experimentation and report			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Master Lab 3	Compulsory	Ungraded	100%
Learning outcome	The students have experiences in practical working in a modern science lab. Depending on their selection they know the most important preparative (P) or analytic (A) tools for solid materials and how to use them. (The learning outcome of the module consist of the selection of the experiments and their specific learning outcomes.) They have realized the need and importance of safe lab working and acquired the ability to provide rules and equipment for this. The students can work safe and effective under lab conditions They work in a team and know how to arrange tasks and time. The students are able to document their work in an appropriate way and can summarize their results in intelligible and precise lab reports.			
Content	Hands-on experiments on selected topics in Materials Science and Engineering and related fields. (P -) indicates preparative and (A -) analytic tools and the specific learning outcome. 8 experiments out of the following list without repetition in module mawi-709, mawi-804 and mawi-938: • M101 Evaporation Methods (P – knowledge of and experiences in evaporation deposition) • M102 Spin Coating (P – knowledge of and experiences in thin film deposition by means of spin coating) • M103 Nanostructuring of Copper surfaces (P – knowledge of properties nanostructured surfaces and experiences of their preparation) • M104 Etching of Semiconductors (P – knowledge of and experiences in etching of semiconductors) • M105 Micro Electromechanical Systems (P – knowledge of and experiences in lithography processes needed to process MEMS) • M106 Vibrating Sample Magnetometry (A – knowledge of and experiences in magnetic characterization of ferromagnetic samples) • M107 Chemical Solution Deposition of Lead Zirconate Titanate Thin Films (P/A – knowledge of piezo electric materials and experiences in their preparation) • M108 Atomic Force Microscopy (A – knowledge of and experiences in studying surface morphology) • M109 Scanning Electron Microscopy (A - knowledge of and experiences in studying bulk morphology) • M110 Differential Thermal Analysis (A - knowledge of and experiences in thermal analysis of materials) • M111 Biocompatibility Tests of Materials (P/A - knowledge of and experiences in testing the biocompatibility of materials)			

	• M112 Scanning Tunnel Microscopy (A - knowledge of and experiences in contact free studying surface morphology) • M202 Sorption and Diffusion in Membranes (P - knowledge of and experiences in thermal gravimetric analysis) • M203 Photocatalysis (A - knowledge of and experiences in characterizing photo catalysis) • M205 Magnetostrictive Materials (P/A - knowledge of and experiences in characterizing of magneto restrictive materials) • M206 Tunnelling Magneto Resistance (A - knowledge of and experiences in characterizing magento resistance) • M208 Impedance Spectroscopy (A - knowledge of and experiences in impedance spectroscopy) • M209 MOKE Microscopy (A - knowledge of and experiences in characterizing materials by means of magneto-optical kerr effect) • M210 X-ray Photoelectron Spectroscopy (A - knowledge of and experiences in chemical characterizing of a surface) • M211 Dynamical-Mechanical Analysis of Polymers (A - knowledge of and experiences in characterizing mechanical properties of solid materials) • M213 Shape Memory Alloys (A - knowledge of and experiences in characterizing mechanical properties of shape memory alloys) • M214 Delta-E-Effect Sensor (A - knowledge of and experiences in delta-E-sensors and their characteristics) • M215 Composition Analysis of Heterostructure Lasers (A - knowledge of and experiences in characterizing materials by means of TEM)
Media	Transmission and measurement equipment
Literature	Manuals are available for all experiments at www.tf.uni-kiel.de/servicezentrum/en/materials-sciencs-lab-courses. They contain individual literature references for all experiments.

Module number	**Mawi949-01a**			
Module title	**Electron Microscopy**			
Module level	Deepening Materials Science			
Abbreviation	ELM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. L. Kienle			
Lecturer	Prof. Dr. L. Kienle and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory /Compulsory elective*	*SWS*
	Lecture	Electron Microscopy	compulsory	3
	Practical Exercises	Electron Microscopy	compulsory	2
Workload	45 h lecture 30 h exercise 75 h self-organized studies 60 h revision 210 h total workload			
Credits	7 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	Basic lecture in physics			

Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Electron Microscopy	Compulsory	Graded	100%
Learning outcome	On successful completion of this module students have gained knowledge about the setup and the technology of electron microscopes. They have gained an insight in the work, the handling, and the possibilities of a TEM. The students are able to outline strategies for analysing unknown materials using the methods introduced in the lectures.			
Content	• Introduction to TEM and SEM • Hardware • Imaging, Diffraction, Spectroscopy • Electron crystallography • Theory of domain crystals • Advanced analytical techniques • Characterization of magnetic structure • EM in Material Science • In situ observations • TEM on nanomaterials • Real structure and diffuse scattering • Crystal defects, e.g. twinning • Combined approach for structure analysis			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• Williams, C. B. Carter : Transmission Electron Microscopy- A Textbook for Materials Science 2nd Edition Springer 2009 • L. Reimer, H. Kohl: Transmission Electron Microscopy: Physics of Image Formation, Springer 2009			

Module number	**Mawi950-01a**			
Module title	**Micro- and Nanosystem Technology**			
Module level	Deepening Materials Science			
Abbreviation	MNST			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. E. Quandt Prof. Dr. B. Wagner			
Lecturers	Prof. Dr. E. Quandt, Prof. Dr. B. Wagner and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Micro- and Nanosystem Technology	compulsory	3
	Lab course	Micro- and Nanosystem Technology	compulsory	2
Workload	45 h lecture 30 h lab course 75 h self-organized studies 60 h revision 210 h total workload			
Credits	7			
Prerequisites according to examination order	None			
Recommended	Basics in solid state physics			

prerequisites	Basics in materials science Basics in optics			
Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Micro- and Nanosystem Technology	Compulsory	Graded	100%
Learning outcome	The students have knowledge about the theoretical background and practical exercise in the clean room laboratory in view of a typical device fabrication. They know specific techniques involved in MEMS fabrication as UV-lithography and plasma enhanced chemical vapour deposition and have practical experiences on this. The students can work safe and to specific cleanroom regulations.			
Content	• Introduction to micro- and nanosystem technology • Cleanroom technology • Optical and electron beam lithography • Thin film deposition: PECVD, sputtering, evaporation, pulse laser deposition • Wet and dry etching • Optical and scanning electron microscope inspection • MEMS materials • MEMS technologies • Doping of silicon • Micromechanical sensors • Piezoelectric transducers • Thermal sensors and actuators • MOEMS • MEMS packaging			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• Marc J. Madou, Fundamentals of microfabrication: the science of miniaturization, CRC Press, 2002 • J. Plummer, M. Deal, P. Griffin, Silicon VLSI technology, Prentice Hall 2000 • M.A. McCord, M.J. Rooks, Handbook of Microlithography, Micromachining and Microfabrication – Vol 1, SPIE Optical Engineering Press, 1997 • P. Rai-Choudhury, Handbook of microlithography, micromachining, and microfabrication – Vol 2, SPIE Optical Engineering Press [u.a.], 1997 • Chang Liu, Foundations of MEMS, Pearson Education, New Jersey, 2006 • Sergey E. Lyshevski, MEMS and NEMS: Systems, Devices, and Structures, Series: Nano- and Microscience, Engineering,			

	Technology and Medicine Volume: 2, CRC Press, New York, 2002

Module number	**Mawi951-01a**			
Module title	**Semiconductors and Defects**			
Module level	Advanced Materials Science			
Abbreviation	SCD			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. R. Adelung			
Lecturer	Prof. Dr. R. Adelung and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Semiconductors and Defects	compulsory	2
	Practical Exercises	Semiconductors and Defects	compulsory	1
Workload	30 h lecture 15 h exercise 75 h self-organized studies 30 h revision 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Lecture Advanced Mathematics Basic in semiconductor theory Basics in silicon technology Basics in thin film technology			
Course related work	Exercises are seminar-styled. Student groups (2-3) present a specified topic and write it down in a formalized way (paper as in conference proceedings)			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Semiconductors and Defects	Compulsory	Graded	100%
Learning outcome	The students know the essentials of semiconductor physics and technology with a focus on semiconductors other than Si, important products, and key technologies. They have a thorough understanding of semiconductor physics, from the free electron gas to topics like Shockley-Read-Hall theory, advanced junction theory or quantitative Laser conditions. The students have a good understanding of various semiconductors in terms of properties and limits. They have a thorough understanding of the basics of LED's and semiconductor Lasers plus a deeper insight into some selected specialities. The students have basic knowledge of some special semiconductors (e.g. organic semiconductors, selected II-VI's, or SiC). Students are able to understand the rapid advances of semiconductor products and technology within a framework consisting of theory, specific material properties and limitations, and available technology. They emerge with a broad competence in dealing with the specific physical semiconductor culture (including the "slang") and are able to deal with the mathematics, often encountered in the form of rather long equations because they understand the underlying basic principles. They are ready to assume suitable engineering positions in the industry with a minimum of introductory time.			
Content	• *Band theory* Essentials of the Free Electron Gas; Energy Gaps and General Band Structure; Periodic Potentials and Bloch's Theorem; Band Structures and Standard Representations. • *Semiconductor physics* Intrinsic properties in equilibrium; Doping, carrier concentration, mobility, and conductivity; Lifetime and diffusion length; Effective masses; Quasi Fermi energies; Shockley-Read-Hall recombination; Junctions and devices. • *Fundamentals of optoelectronics* Materials and radiant recombination; Recombination and luminescence; Doping of compound semiconductors; Wavelength engineering; Light and semiconductors; Total			

	efficiency of light generation; Absorption and emission of light. • *Heterojunctions* Ideal heterojunctions; Isotype junctions, modulation doping, and quantum effects; Real heterojunctions; Quantum devices; Single and multiple quantum wells. • *Principles of the semiconductor LASER* LASER conditions; Interaction of light and electrons and inversion; Light amplification in semiconductors; From amplification to oscillation; Second Laser condition; Laser modes. • *Light emitting devices* Basic requirements and design principles; Products, market, materials, and technologies; Selected LED concepts; Optimizing light confinement and gain in Laser diodes; Double heterojunctions; Key technologies. • *Special Semiconductor* Siliconcarbide, Materials aspects and applications; Galliumnitride; II - VI Semiconductors; Semiconducting polymers.
Media	Blackboard, lecture notes Digital presentation (available in the internet)
Literature	Complete interactive internet script http://www.tf.uni-kiel.de/matwis/amat/semi_en/index.html Selected text books for special topics given in script

Module number	**Mawi952-01a**
Module title	**Smart Materials**
Module level	Deepening Materials Science
Abbreviation	SM
Subtitle (if applicable)	
Duration	1 Semester
Repetition in academic year	Winter Term
Responsible faculty	Faculty of Engineering
Responsible institute	Institute for Materials Science
Responsible staff member	Prof. Dr. E. Quandt
Lecturer	Prof. Dr. E. Quandt and staff
Teaching language	English
Assignment to the curriculum	Compulsory elective subject in term 3
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering
Evaluation	Graded

Module courses	*Course Type*	*Course Name*	*Compulsory/Compulsory elective*	*SWS*
	Lecture	Smart Materials	compulsory	2
	Practical Exercises	Smart Materials	compulsory	1

Workload	30 h lecture 15 h exercise 75 h self-organized studies 30 h revision 150 h total workload
Credits	5
Prerequisites according to examination order	None
Recommended prerequisites	Basics in solid state physics Basics in materials science

Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Smart Materials	Compulsory	Graded	100%
Learning outcome	The students have basic knowledge about the domain of smart materials. The students know the correlation between composition, microstructure and properties of smart and multiferroic materials. They have a compendium for themselves over smart materials for understanding new approaches to materials sciences problems. The students know scientific purchase as well as bulk fabrication rules.			
Content	*Smart Materials* • Classification • Application Areas *Piezoelectric Materials* • Piezoeffect • Piezoelectric Materials • Ferroelectricity • Fabrication • Applications *Magnetostrictive Materials* • Magnetostriction • Cryogenic Materials • Rare Earth - Fe phases • Thin Film Materials • Applications *Shape Memory Alloys* • Shape Memory Effects • Superelasticity • TiNi - based materials • Shape Memory Thin Films • Applications *Multiferroic Materials* • Magnetic Shape Memory Materials • Magnetoelectric Composites			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• K. Uchino, Ferroelectric Devices, New York: Marcel Dekker, 2000 • Giant magnetostrictive materials: physics and device applications, Ed: G. Engdahl. San Diego: Academic Press, 2000			

	• C. M. Wayman und K. Otsuka, Shape Memory Materials, Cambridge University Press, 1999

Module number	**Mawi953-01a**			
Module title	**Thin Films**			
Module level	Deepening Materials Science			
Abbreviation	TF			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. K. Rätzke			
Lecturer	Prof. Dr. K. Rätzke and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/Compulsory elective*	*SWS*
	Lecture	Thin Films	compulsory	3
	Practical Exercises	Thin Films	compulsory	2
Workload	45 h lecture 30 h exercise 75 h self-organized studies 60 h revision 210 h total workload			
Credits	7			
Prerequisites according to examination order	None			
Recommended prerequisites	Lectures “Advanced Materials A”, “Solid State Physics” and “Analytics”			

Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Thin Films	Compulsory	Graded	100%
Learning outcome	The students are familiar with vacuum technology and deposition systems, can compare different techniques for that and select the appropriate method for their experiments. They can perform simple calculations with respect to vacuum. They can perform experiments on thin film deposition apparatus and understand the background of the machines (not black boxes anymore). They know the relation between deposition parameters and the corresponding thin film microstructure and can select proper methods to analyse their samples. They can develop own experiments and justify their decisions.			
Content	• Vacuum physics • Deposition methods • Properties of Thin Films • Thin film growth characterization • Epitaxy • Microstructural evolution • Interdiffusion and reactive diffusion • Mechanical properties • Electrical, magnetic and optical properties • Thin polymeric films			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• M. Ohring, The Materials Science of Thin films, Academic Press, 1992, 2000 2nd edition • D.L. Smith, Thin Film Deposition, McGraw Hill, 1995 • K.N. Tu et al. Electronic Thin Film Science, Macmillan, 1992 • R.C. O'Handley, Modern Magnetic Materials, Wiley, 2000			

Module number	**Mawi 918**			
Module title	**Advanced Metallic Materials**			
Module level	Deepening Materials Science			
Abbreviation	AMM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible Institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. F. Faupel			
Lecturer	Prof. Dr. F. Faupel and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/Compulsory elective*	*SWS*
	Advanced Seminar	Advanced Metallic Materials	compulsory	2
Workload	30 h seminar 45 h self-organized studies 15 h preparation of presentation 90 h total workload			
Credits	3 ECTS			
Prerequisites according to examination order	None			
Recommended Prerequisites	Basics in Metals			
Course related work	None			

Examination(s)	Presentation with written summery			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Advanced Metallic Materials	Compulsory	Graded	100%
Learning outcome	The students are able to make themselves familiar with complex materials concepts and design principles related to metallic materials. They can draw information not only from textbooks but also from state of the art review articles and original literature. They can critically assess the search results and can select the crucial information and condense it into a review talk. They can prepare an interesting presentation in terms of both layouts of the slides and presentation style. They can defend their presentation in a scientific discussion. They are able to discuss critically the presentations of fellow students. They can chair sessions. They are able to assess their own performance and that of fellow students.			
Content	Each participant gives a talk on a topic in the field of advanced metallic materials. The topics range from processing through structural and functional properties to applications. The talks are followed by a discussion.			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	It is part of the task to find appropriate literature. On request, the lecturer gives hints also with respect to the outline of the presentation.			

Module number	**Mawi 919**			
Module title	**Advanced Organic Materials**			
Module level	Deepening Materials Science			
Abbreviation	AOM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. F. Faupel			
Lecturer	Prof. Dr. F. Faupel and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Advanced Seminar	Advanced Organic Materials	compulsory	2
Workload	30 h seminar 45 h self-organized studies 15 h preparation of presentation 90 h total workload			
Credits	3 ECTS			
Prerequisites according to examination order	None			
Recommended Prerequisites	Basics in Polymers			
Course related work	None			

Examination(s)	Presentation with written summery			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Advanced Organic Materials	Compulsory	Graded	100%
Learning outcome	The students are able to make themselves familiar with complex materials concepts and design principles related to organic materials. They can draw information not only from textbooks but also from state of the art review articles and original literature. They can critically assess the search results and can select the crucial information and condense it into a review talk. They can prepare an interesting presentation in terms of both layouts of the slides and presentation style. They can defend their presentation in a scientific discussion. They are able to discuss critically the presentations of fellow students. They can chair sessions. They are able to assess their own performance and that of fellow students.			
Content	Each participant gives a talk on a topic in the field of advanced organic materials. The topics range from processing through structural and functional properties to applications. The talks are followed by a discussion.			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	It is part of the task to find appropriate literature. On request, the lecturer gives hints also with respect to the outline of the presentation.			

Module number	**Mawi954-01a**			
Module title	**Statistical Methods in Materials Science**			
Module level	Deepening Materials Science			
Abbreviation	SMMS			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Dr. J. Carstensen			
Lecturer	Dr. J. Carstensen and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Statistical Methods in Materials Science	compulsory	2
	Practical Exercises	Statistical Methods in Materials Science	compulsory	1
Workload	30 h lecture 15 h exercise 60 h self-organized studies 45 h revision 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			
Recommended Prerequisites	A general understanding of the statistical thermodynamics and its applicability to solid state physics.			

Course related work	None			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Statistical Methods in Materials Science	Compulsory	Graded	100%
Learning outcome	The students have a robust "toolbox" for solving mathematical problems in material science analytically and numerically. They students got a reasonable theoretical mathematical background and a basic understanding of numerical algorithms for an efficient use of computers. The students can write programs in Mathlab for visualizing results in 2D and 3D, analyse measured data and solve transcendent equations and differential equations. By teamwork in the programming part they have improved their social skills.			
Content	• Laws of thermodynamics and thermodynamic potentials • Legendre-transformation for the calculation of the thermodynamic potentials for different contacts and application for several examples centering around the physical interpretation of the entropy • Statistical approach for the calculation of the partition function for the evaluation of the thermodynamic potentials • Calculation of phase diagrams, formation entropy of dislocations and voids, and spontanic magnetization • Concepts to describe nonequilibrium processes in terms of the equilibrium thermodynamic formalism. • Semiconductor-LASER and the Boltzmann-equation for current and diffusion processes			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• S.M. Sze, Physics of Semiconductor Devices, John Wiley & Sons, New York 1981 • Ashcroft/Mermin, Solid state physics, Saunders College Publishing • P.S. Kirejew, Physik der Halbleiter, Akademischer Verlag Berlin, 1974 • Wolfgang Weidlich, Thermodynamik und statistische Methoden, Akademische Verlagsgesellschaft, Wiesbaden 1976 • 5. Albrecht Winnacker, Physik von Maser und Laser, BI Wissenschaftsverlag, Zürich 1984			

Module number	**Mawi 921**			
Module title	**Magnetic Materials: Physics and Applications**			
Module level	Deepening Materials Science			
Abbreviation	MagMat			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. J. McCord			
Lecturer	Prof. Dr. J. McCord and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Magnetic Materials: Physics and Applications	compulsory	2
	Practical Exercises	Magnetic Materials: Physics and Applications	compulsory	1
Workload	30 h lecture 15 h exercise 60 h self-organized studies 45 h revision 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended Prerequisites	Basic lecture materials science			
Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Magnetic Materials: Physics and Applications	Compulsory	Graded	100%
Learning outcome	The students are able to plan and conduct magnetic material analyses to obtain key properties of magnetic systems. They assess magnetic materials for a specific application based on their right material properties and select and correlate the relevant material properties with respect to their applicability to an exemplary application. The students interpret which underlying magnetic process causes a measurable quantity. Furthermore, they can illustrate magnetization reversal processes with their influencing mechanisms and, additionally, sketch various magnetic sensing principles. The students explain various characterization methods as well as approaches to model magnetization behaviour. They list specific analysis methods for various magnetic quantities, memorize examples for materials with extraordinary properties, and name effects and methods related to magnetic materials.			
Content	• Fundamentals of magnetism • Manifestations of magnetism • Magnetic anisotropies • Magnetization processes • Magnetic domains • Soft magnetic materials • Hard magnetic materials • 8. Spin electronics and magnetic recording			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Robert C. O'Handley - Modern Magnetic Materials: Principles and Applications B. D. Cullity , C. D. Graham - Introduction to Magnetic Materials J. M. D. Coey - Magnetism and Magnetic Materials			

Module number	**Mawi955-01a**			
Module title	**Chemistry and Physics of Biomaterials**			
Module level	Deepening Materials Science			
Abbreviation	CaPoB			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. R. Willumeit-Römer			
Lecturer	Prof. Dr. R. Willumeit-Römer and staff			
Teaching Language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Chemistry and Physics of Biomaterials -Biomaterial applications	compulsory	3
	Seminar	Chemistry and Physics of Biomaterials - Biological Materials	compulsory	1
	Practical Exercises	Chemistry and Physics of Biomaterials -	compulsory	1
Workload	45 h lecture 15 h seminar 15 h exercise 75 h self-organized studies 60 h lecture revision 210 h total workload			

Credits	7 ECTS			
Prerequisites according to examination order	None			
Recommended Prerequisites	Advanced Materials A Seminar "Biochemie für Materialwissenschaftler"			
Course related work	None			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Chemistry and Physics of Biomaterials	Compulsory	Graded	100%
Assessment of course achievements	The students judge biomaterial properties with respect to their medical application and know how to use theory to understand mechanical / chemical properties of biomaterials. They can calculate the forces acting on biomaterials and can deduct which material is suitable for which tissue. The students can decide which experimental techniques are useful to study biomaterials.			
Content	The course focuses on the interaction of the living environment with artificial materials. Content of the lectures: • Basics of biochemistry • Definition: what is a biomaterial? • Biomimetics – Friction as an example of application • Wetting properties focused on the aspects of cell adhesion • Tissue and implant requirements • Different implant types: metallic, polymeric, ceramic implants • Drug delivery • Biomedical devices and approval procedure In the exercises and seminars, current experimental and theoretical topics in biomaterials research will be discussed.			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• Lehninger: Biochemistry (or a similar text book). • DF Williams, Biomaterials 35 (2014) 10009 - 10014. • J. Park and R.S. Lakes: Biomaterials – an Introduction. Springer 2007 • J.J Sela and I.A. Bab: Principles of Bone Regeneration. Springer 2012 • B. Ratner et al.: Biomaterial Science: An Introduction to Materials in Medicine. Academic Press 1996 • Additional material (scientific articles, book chapters) will be handed out during the course.			

Module number	**Mawi 931**			
Module title	**Selected Topics in Materials Science**			
Module level	Deepening Materials Science			
Abbreviation	STMS			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Dr. O. Riemenschneider			
Lecturer	Professors of the Institute and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/Compulsory elective*	*SWS*
	Advanced Seminar	Selected Topics in Materials Science	compulsory	2
Teaching methods	2 SWS seminar			
Workload	30 h seminar 15 h seminar revision 45 h self-organized studies 90 h total workload			
Credits	3 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	Deepened knowledge in Materials Science			

Course related work	• Interested students must attend a preparatory meeting (compulsory attendance) • Each student can select a topic offered by the research group "Synthesis and Real Structure" • All students must attend all presentations			
Examination(s)	Presentations (30 min) given by the students. Content and presentation technique will be discussed (30 min). Written summery (10 pages)			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Selected Topics in Materials Science	Compulsory	Graded	100%
Learning outcome	The students are familiar performing autonomously literature search for a given, unknown topic. They can summarize the gained knowledge in a short manuscript and in a scientific talk.			
Content	Every student will get a topic of actual research, which she/he has to work on. One responsible professor will coach each of them.			
Media	Digital presentation			
Literature	*Given by the responsible professor.*			

Module number	**Mawi 932**			
Module title	**Selected Topics in Solid State Chemistry**			
Module level	Deepening Materials Science			
Abbreviation	STSSC			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. L. Kienle			
Lecturer	Prof. Dr. L. Kienle and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Advanced Seminar	Selected Topics in Solid State Chemistry	compulsory	2
Workload	30 h seminar 15 h seminar revision 45 h self-organized studies 90 h total workload			
Credits	3 ECTS			
Prerequisites according to examination order	None			
Recommended Prerequisites	General knowledge of chemistry basics, particularly solid state chemistry, solid state physics, crystallography and structural chemistry (e.g. as treated in the lecture Material Science 3)			

Course related work	• Up to five topics (for five students) will be announced! • Interested students must attend a preparatory meeting (compulsory attendance) • Each student can select a topic offered by the research group "Synthesis and Real Structure" • All students must attend all presentations			
Examination(s)	Presentations (30 min) given by the students. Content and presentation technique will be discussed (30 min). Written summery (10 pages).			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Selected Topics in Solid State Chemistry	Compulsory	Graded	100%
Learning outcome	On successful completion of this module students are familiarize with a given, unknown topic performing autonomously literature search. They can summarize the gained knowledge in a short manuscript and in a scientific talk.			
Content	Each student must perform literature search of relevant source articles independently (ISI-web or similar scientific search engines, no plain web pages). The literature list must be discussed with Prof. Kienle and/or staff. Afterwards each students must write successfully a summary paper of 10 pages (template will be provided).			
Media	Digital presentation			
Literature	need to be searched by the candidate			

Module number	**Mawi 933**			
Module title	**Optical Materials**			
Module level	Deepening Materials Science			
Abbreviation	OEM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. J. McCord			
Lecturer	Prof. Dr. J. McCord and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Advanced Seminar	Optical Materials	compulsory	2
Workload	30 h seminar 45 h preparation 15 h revision 90 h total workload			
Credits	3 ECTS			
Prerequisites according to examination order	None			
Recommended Prerequisites	Advanced Materials B Solid State Physics Semiconductors			

Course related work	None			
Examination(s)	Presentation and written summery.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Optical Materials	Compulsory	Graded	100%
Learning outcome	The students are able to make themselves familiar with complex optical materials concepts. They prepare information from textbooks and secondary literature for a lecture to an undergraduate student audience. They can prepare a university lecture style presentation. The students comprehend the optical and optoelectronic material properties and devices. On completion of this module, the students will be able to relate the properties of optical materials to specific applications.			
Content	Contents to be reviewed and prepared by the students: • Wave nature of light • Dielectric waveguides and optical fibers • Semiconductor science and Light-Emitting Diodes • Stimulated emission devices: Optical amplifiers and lasers • Photodetectors and image sensors • Polarization and modulation of light			
Media	Blackboard, lecture notes Digital presentation			
Literature	S.O. Kasap, Optoelectronics & Photonics: Principles & Practices (Pearson, 2013)			

Module number	**mawi 934**			
Module title	**Advanced Topics in Organic Materials**			
Module level	Deepening Materials Science			
Abbreviation	ATOM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. F. Faupel			
Lecturer	Prof. Dr. F. Faupel and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Advanced Seminar	Advanced Topics in Organic Materials	compulsory	2
Workload	30 h seminar 30 h literature work 30 h preparation for exam 90 h total workload			
Credits	3 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Advanced knowledge on polymers and materials science, basic knowledge on solid state physics and organic chemistry			
Course related work	None			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Advanced Topics in Organic Materials	Compulsory	Graded	100%
Learning outcome	The students are able to make themselves familiar with complex materials concepts and design principles related to organic materials. They can draw information not only from textbooks but also from state of the art review articles and original literature. They can critically assess the search results and can select the crucial information and condense it into a review talk. They can prepare an interesting presentation in terms of both layout of the slides and presentation style. They can defend their presentation in a scientific discussion. They are able to discuss critically the presentations of fellow students. They can chair sessions. They are able to assess their own performance and that of fellow students.			
Content	Depending on time, interests of the students, and the latest developments in the field, the following topics will be covered: • Reinforcement of polymers on all length scales • Functional polymer nanocomposites • Liquid crystalline polymers • Conducting and semiconducting polymers • Polymers in microelectronics • Polymer electrolytes • Ferroelectric polymers • Polymer electrets • Organic thin films • Polymer surfaces • Shape-memory polymers • Electroactive polymers • Polymer gels • Adhesives			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Since the lecture aims at including the latest developments in the field, the updated literature will be given in the lecture and in the lecture notes which are available on the website of the Chair for Multicomponent Materials.			

Module number	**mawi 935**			
Module title	**Advanced Topics in Metallic Materials**			
Module level	Deepening Materials Science			
Abbreviation	ATMM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. K. Rätzke			
Lecturer	Prof. Dr. K. Rätzke and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Advanced Seminar	Advanced Topics in Metallic Materials	compulsory	2
Workload	30 h seminar 30 h literature work 30 h preparation for exam 90 h total workload			
Credits	3 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	General knowledge of chemistry, basics solid state physics, crystallography and structural chemistry lecture advanced materials A / metals			
Course related work	None			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Advanced Topics in Metallic Materials	Compulsory	Graded	100%
Learning outcome	The students have an in depth understanding of structure and properties of metals. They understand alloy design, can read phase diagrams and can apply it to new problems. The students can predict properties from alloy content and thermal history. They can select proper alloys for given applications and motivate their choice. They are familiar with basic structure-property relations. They know latest developments in metal science and can critically assess latest developments.			
Content	• Ferrous alloys (Steel, cast iron) • Non ferrous engineering alloys (Al, Cu, Mg, …) • Special alloys (metallic glasses, quasicrystals, intermetallics, metallic foams, High entropy alloys) • Special properties (superplasticity, electromigration, hydrogen in metals and others)			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• Askeland, S*cience and Engineering of Materials* • Shackelford, *Introduction into Materials Science for Engineers* • Haasen, *Physical Metallugry*			

Module number	**mawi940-01a**			
Module title	**Linear Finite Element Methods**			
Module level	Deepening Materials Science			
Abbreviation	LFEM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr.-Ing. S. Wulfinghoff			
Lecturer	Prof. Dr.-Ing. S. Wulfinghoff and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Linear Finite Element Methods	compulsory	2
	Practical Exercises	Linear Finite Element Methods	compulsory	1
Workload	30 h seminar 15 h exercise 40 h self-organized studies 65 h preparation of exercises 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Vector and matrix calculus, coordinate systems, partial derivatives and differential equations, differential operators, volume and surface integrals			
Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Linear Finite Element Methods	Compulsory	Graded	100%
Learning outcome	The students are able to apply the finite element method for the solution of certain ordinary and partial differential equations, as they occur in different physical disciplines to model, e.g., mechanical, electrostatic, or thermal systems. The students have theoretical and basic programming skills. They are able to implement crucial parts of finite element programs in teams. They have knowledge about fundamentals for the independent application of linear finite element method, which is required to solve numerous problems in materials science and engineering. The students have improved their social capabilities by solving exercises in small groups.			
Content	• Boundary value problems from various fields of physics • Strong and weak formulation • Shape functions, isoparametric concept • Assembly of stiffness matrix and force vector • Numerical integration • Solution of linear equation systems			
Media	Lectures and computer aided exercises, external resources			
Literature	• M. Jung, U. Langer: Methode der finiten Elemente für Ingenieure, Springer • J. Fish, T. Belytschko: A First Course in Finite Elements, Wiley • T. J. R. Hughes: The Finite Element Method: Linear Static and Dynamic Finite Element Analysis, Dover Publications • O.C. Zienkiewicz, R.L. Taylor: The Finite Element Method, London: McGraw-hill			

Module number	**mawi941-01a**			
Module title	**Selected Topics in Computational Materials Science**			
Module level	Deepening Materials Science			
Abbreviation	STCMS			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter or Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr.-Ing. S. Wulfinghoff			
Lecturer	Prof. Dr.-Ing. S. Wulfinghoff and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Advanced Seminar	Selected Topics in Computational Materials Science	compulsory	2
Workload	15 h seminar 15 h seminar revision 60 h self-organized studies 90 h total workload			
Credits	3 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	Vector and matrix calculus, coordinate systems, partial derivatives and differential equations, differential operators, volume and surface integrals			

Course related work	Submission and presentation of exercises			
Examination(s)	Oral Examaination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Selected Topics in Computational Materials Science	Compulsory	Graded	100%
Learning outcome	The students are able to apply special nonlinear continuum methods for the solution of related problems with a special emphasis on mechanical systems. They are able to explain the main features of the aforementioned theories. They can apply related solution schemes and elucidate their structure. The students have knowledge in fundamentals for the independent application of different methods in solid mechanics, which are required to solve numerous problems in materials science and engineering. The students improve their social capabilities by solving exercises in small groups.			
Content	• Continuum mechanical fundamentals • Nonlinear mechanical problems • Different problem formulations • Simplifications • Solution procedures			
Media	Black board and projector			
Literature	• P. Wriggers: Nonlinear finite element methods, Springer • J. C. Simo: Numerical analysis and simulation of plasticity, Elsevier • G. A. Holzapfel: Nonlinear solid mechanics: a continuum approach for engineering science, Wiley			

Module number	**mawi942-01a**			
Module title	**Computational Modeling of Inelastic Material Behavior**			
Module level	Deepening Materials Science			
Abbreviation	CoMIMaB			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr.-Ing. S. Wulfinghoff			
Lecturer	Prof. Dr.-Ing. S. Wulfinghoff and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Computational Modeling of Inelastic Material Behavior	compulsory	2
	Practical Exercises	Computational Modeling of Inelastic Material Behavior	compulsory	1
Workload	30 h seminar 15 h exercise 40 h self-organized studies 65 h preparation of exercises 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Vector and matrix calculus, coordinate systems, partial derivatives and differential equations, differential operators			
Course related work	Submission and presentation of exercises			
Examination(s)	Presentation and written summery.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Computational Modeling of Inelastic Material Behavior	Compulsory	Graded	100%
Learning outcome	The students are able to model inelastic material behavior by ordinary differential equations. They can apply numerical methods to solve the equations. They can explain different inelastic material models used in viscoelasticity and plasticity. They can solve the related equations numerically. They have knowledge about fundamentals for the independent application of inelastic material models, which are required to solve numerous problems in materials science and engineering. The students improve their social capabilities by solving exercises in small groups.			
Content	• Programming • Nonlinear solid mechanics • Viscoelasticity • Plasticity • Numerical solution of material model equations • Embedding into finite element programs			
Media	Lectures and computer aided exercises, external resources			
Literature	• J. C. Simo, T. J. R. Hughes: Computational inelasticity, Springer • J. C. Simo: Numerical analysis and simulation of plasticity, Elsevier • P. Wriggers: Nonlinear finite element methods, Springer			

Module number	**mawi943-01a**			
Module title	**Finite Element Methods**			
Module level	Deepening Materials Science			
Abbreviation	FEM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr.-Ing. S. Wulfinghoff			
Lecturer	Prof. Dr.-Ing. S. Wulfinghoff and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 4			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecturer	Finite Element Methods	compulsory	2
	Practical Exercises	Finite Element Methods	compulsory	2
Workload	30 h seminar 30 h exercise 50 h self-organized studies 100 h preparation of exercises 210 h total workload			
Credits	7 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Vector and matrix calculus, coordinate systems, partial derivatives and differential equations, differential operators, volume and surface integrals			
Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Finite Element Methods	Compulsory	Graded	100%
Learning outcome	The students are able to model inelastic material behavior by ordinary differential equations. They can apply numerical methods to solve the equations. They can explain different inelastic material models used in viscoelasticity and plasticity. They can solve the related equations numerically. They have knowledge about fundamentals for the independent application of inelastic material models, which are required to solve numerous problems in materials science and engineering. The students improve their social capabilities by solving exercises in small groups.			
Content	• Programming • Nonlinear solid mechanics • Viscoelasticity • Plasticity • Numerical solution of material model equations • Embedding into finite element programs			
Media	Lectures and computer aided exercises, external resources			
Literature	• J. C. Simo, T. J. R. Hughes: Computational inelasticity, Springer • J. C. Simo: Numerical analysis and simulation of plasticity, Elsevier • P. Wriggers: Nonlinear finite element methods, Springer			

Module number	**mawi945-01a**			
Module title	**Synchrotron Techniques for Materials Characterization**			
Module level	Deepening Materials Science			
Abbreviation	SnycMac			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Dr. C. Zeller-Plumhoff			
Lecturer	Dr. C. Zeller-Plumhoff and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Synchrotron techniques for materials characterization	compulsory	2
	Practical Exercises	Synchrotron techniques for materials characterization	compulsory	2
Workload	30 h lecture 30 h exercises 30 h self-organized studies 40 h preparation of exercises 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Fundamentals in physics and mathematics Basic knowledge in programming (optional)			
Course related work	During the course of the exercises, the students are expected to hand in a written report on one of the exercise topics. A tutorial will consist of programming exercises chiefly in Matlab.			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Synchrotron techniques for materials characterization	Compulsory	Graded	100%
Learning outcome	The students know how to plan synchrotron radiation computed tomography and diffraction experiments according to the requirements of different materials. They will further be able to analyze data that may result from such experiments. Furthermore, they can interpret image artefacts and implement different simple algorithms for image processing to improve image quality prior to the analysis. The students will know the fundamentals of generation of synchrotron radiation and can make comparisons to laboratory CT and diffraction techniques.			
Content	• Basics of the generation of synchrotron radiation and techniques • Computed tomography and diffraction • Comparison to the laboratory setups • Contrast modes for different materials • Techniques for imaging at higher resolution • Image processing, reconstruction and analysis			
Media	Lectures and computer aided exercises, external resources			
Literature	Updated literature will be given in the lecture and in the lecture notes.			

Module number	**mawi946-01a**			
Module title	**Advanced Continuum Mechanics**			
Module level	Deepening Materials Science			
Abbreviation	ACM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr.-Ing. S. Wulfinghoff			
Lecturer	Prof. Dr.-Ing. S. Wulfinghoff and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Advanced Continuum Mechanics	compulsory	2
	Practical Exercises	Advanced Continuum Mechanics	compulsory	1
Workload	30 h seminar 30 h exercise 60 h self-organized studies 30 h preparation of exercises 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Vector and matrix calculus, coordinate systems, partial derivatives and differential equations, differential operators, volume and surface integrals, integral theorems (Gauss' theorem), tensor calculus.			
Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Advanced Continuum Mechanics	Compulsory	Graded	100%
Learning outcome	The students know the fundamentals of continuum mechanics at large deformations. The knowledge comprises the kinematics, the essential balance laws as well as exemplary material models. Capabilities. The students are able to understand and to apply continuum mechanics to engineering systems and the solution of problems in materials science in general. The students improve their social capabilities by solving exercises. Thus, their competence to solve problems in time is supported.			

Content	• Matrix- and tensor calculus (repetition):
	  ○ vector- and tensor algebra
	  ○ tensor analysis
	• Kinematics:
	  ○ displacement field
	  ○ rigid body motion
	  ○ deformation gradient, polar decomposition
	  ○ strain measures
	• Stresses:
	  ○ traction vector
	  ○ stress tensors
	• Balance laws in continuum mechanical form:
	  ○ mass balance
	  ○ linear and angular momentum balance
	  ○ 1. & 2. laws of thermodynamics
	• Material models			

Media	Lectures and computer aided exercises, external resources			
Literature	• G. A. Holzapfel: Nonlinear solid mechanics: a continuum approach for engineering science, Wiley • M. E. Gurtin, E. Fried, L. Anand: The mechanics and thermodynamics of continua, Cambridge University Press • A. Bertram: Elasticity and plasticity of large deformations, Springer			

Module number	**mawi958-01a**			
Module title	**(Bio)functionalized Polymers**			
Module level	Deepening Materials Science			
Abbreviation	BFP			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Dr. R. Rosencrantz			
Lecturer	Dr. R. Rosencrantz and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Advanced Seminar	(Bio)functionalized Polymers	compulsory	2
Workload	30 h seminar 15 h seminar revision 45 h self-organized studies 90 h total workload			
Credits	3 ECTS			
Prerequisites according to examination order	none			
Recommended prerequisites	Basics in chemistry Basics in biological systems			
Course related work	None			

Examination(s)	Presentation and written summery.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Biofunctionalized Polymers	Compulsory	Graded	100%
Learning outcome	The students have an overview of the use of polymers / plastics in biology-related contexts. Insights into polymer production and the areas of application of the various plastics are gathered. In particular, bio-based polymers as well as the corresponding limitations and analysis methods are clear. The students have an overview of important biotechnological principles and functional biomolecules. Basic methods such as cloning and production of recombinant proteins are understood. The contents can be brought together to understand biohybrid materials, their production and function.			
Content	• *Polymer chemistry* Theory: Use of plastics; bio-based, biodegradable and conventional polymers in comparison, production and characterization of polymers, production types and future developments Methods: gel permeation chromatography, mass spectrometry, mechanical tests, biodegradability studies, biocompatibility studies, controlled synthesis • *Biotechnology* Theory: Functional biomolecules (carbohydrates, peptides, proteins, etc.), functions in nature and technical use, production of recombinant proteins in various expression systems and down stream processing options, stabilization mechanisms, analysis, cell culture Methods: molecular cloning, fermentation, chromatography • *Biofunctionalized polymers* Theory: Manufacturing and sample structures from current research, biofunctionalized polymers in solution, on surfaces and as bulk polymers, polymeric materials in medicine Methods: protein conjugation, biomolecular interactions, surface activation and coating			
Media	Digital presentation (available on the internet)			
Literature	Provided by the lecturer during the course			

Module number	**mawi959-01a**			
Module title	**Advanced Energy Materials**			
Module level	Deepening Materials Science			
Abbreviation	AEM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Dr. Fabian Schütt			
Lecturer	Prof. Dr. R. Adelung Prof. Dr. J. McCord Prof. Dr. Lorenz Kienle Dr. Jürgen Carstensen Dr. Torben Dankwort Dr. Sandra Hansen Dr. Fabian Schütt			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Advanced Energy Materials	compulsory	2
	Advanced Seminar	Advanced Energy Materials	compulsory	2
Workload	30 h lecture 10 h seminar 80 h self-organized studies 30 h revision 150 h total workload			

Credits	5 ECTS			
Prerequisites according to examination order	none			
Recommended prerequisites	Basics in materials science			
Course related work	The seminar will take place in the form of a simulated scientific conference at the end of the semester. The students will choose their own topics, but have to submit a written abstract prior to the conference. Each student must attend all presentations.			
Examination(s)	Presentations and written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Written examination	Compulsory	Graded	50%
	Presentation	Compulsory	Graded	50%
Learning outcome	The students have a basic knowledge about material concepts and design principles related to materials used for energy storage and generation. They know about the recent scientific challenges in the respective fields and have an understanding for new approaches as well as their limitations. Based on the seminar in the style of a conference, students will be familiarized with the typical procedure and structure of a scientific conference. They can chair sessions and will assess their own performance and that of fellow students. The students will thereby further advance in autonomously literature search, scientific writing and scientific presenting. For presentations they can draw information not only from textbooks but also from state-of-the-art review articles and original literature.			
Content	• materials for renewable energy systems • materials for energy storage systems • basic principle of batteries • basic principle of supercapacitors • basic principle of thermoelectrics • basic principle for solar cells • hard and soft magnetic materials for energy applications			
Media	Blackboard, lecture notes, digital presentation (available in the internet)			
Literature	Will be provided during the course.			

Module number	**mawi960-01a**			
Module title	**Data Science for Material Scientists**			
Module level	Deepening Materials Science			
Abbreviation	DSMS			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Dr. B. Zeller-Plumhoff			
Lecturer	Dr. B. Zeller-Plumhoff and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2 or 4			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Advanced seminar	Data science for material scientists	compulsory	2
Workload	30 h seminar 60 h self-organized studies 90 h total workload			
Credits	3 ECTS			
Prerequisites according to examination order	none			
Recommended prerequisites	Fundamentals in mathematics Basic knowledge in programming (ideally Python)			

Course related work	The students need to submit a written report detailing the subject they are presenting in the seminar. This includes the underlying theory of the method they present, as well as a critical assessment of the application case. The presentation will be given during the block seminar, for which a 45-minute time slot is reserved for each student.			
Examination(s)	Presentation and written summery			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Data science for material scientists	Compulsory	Graded	100 %
Learning outcome	The students will have obtained an overview of data science methods and their application in materials science. They can judge and compare the suitability of different methods for a given application. Based on this knowledge, the students will be able to assess which method may be suitable for other application cases in the future. The students will also have basic knowledge of the implementation of different methods in Python.			
Content	The seminar will provide an overview of different data science methods, including supervised and unsupervised learning methods, starting with basic regression models. For each method, an application case from materials science needs to be researched based on published material. The students will present both the method and the application case within the seminar. The students are also encouraged to provide a Python-based implementation of a show case for each method.			
Media	Lectures and computer aided exercises, external resources			
Literature	To be announced			

Module number	**mawi961-01a**			
Module title	**Scientific Writing Online Course**			
Module level	Deepening Materials Science			
Abbreviation	SciWi			
Duration	1 Semester			
Study term	Winter term			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. F. Faupel			
Lecturers	Prof. Dr. F. Faupel and staff together with professionals from Thieme Publishers			
Language	English			
Assignment to the curriculum	Compulsory elective subject in term 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Engineering			
Evaluation	graded			
Module course	Course type	Course name	Compulsory/ compulsory elective	SWS
	Advanced seminar	Scientific writing online course	Compulsory	2
Work load	30 h course attendance 60 h self-organized studies 90 h total workload			
Credits	3 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	Advanced knowledge on materials science as provided in bachelor course and 1st term of master course			
Course related work	None			

Examination(s)	Submission of scientific texts			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Scientific writing online course	Compulsory	Graded	100 %
Learning outcome	The students are able to write scientific texts. They can draw information not only from textbooks but also from state-of-the-art review articles and original literature. They can critically assess the search results and can select the crucial information and condense it into scientific text. They can defend the contents of their texts in a scientific discussion. They are able to discuss critically the texts of fellow students.			
Content	• Introductory lectures on scientific writing • Selections of keywords for online encyclopedia RÖMPP • Weekly consultation with lecturers • Discussion with individual supervisors and lecturers upon appointment The work progress and the acquired skills will be assessed regularly throughout the course in the weekly consultations and the individual appointments. Prior to publication of suitable texts in RÖMPP, they will be edited by Thieme professionals and Prof. Faupel together with the participants.			
Media	The course is online. Lecture notes and video recordings will be provided for the introductory lectures.			
Literature	It is part of the course requirements to find appropriate literature. Occasionally and on request, the lecturers and supervisors will give hints on special literature.			

Module number	**mawi962-01a**			
Module title	**Bioinspired Materials and Molecular Modelling**			
Module level	Deepening Materials Science			
Abbreviation	BioMMM			
Subtitle (if applicable)	–			
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. Z. Altintas			
Lecturer	Prof. Dr. Z. Altintas and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 1 or 3			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	BioMMM	compulsory	2
	Lab Course	BioMMM	compulsory	1
	Seminar	BioMMM	compulsory	1
Workload	60 h lecture 30 h lab course 30 h seminar 90 h self-organized studies 210 h total workload			
Credits	7 ECTS			
Prerequisites according to examination order	none			

Recommended prerequisites	none			
Course related work	none			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Oral or written exam	Compulsory	Graded	50%
	Semester project	Compulsory	Graded	50%
Learning outcome	The students have experiences in discussing the motivation, merits, and challenges in the field of bioinspired imprinted materials. They can describe covalent, semi-covalent and non-covalent imprinting approaches with their advantages and limitations. They are able to determine various production methods of MIPs such as monolith, precipitation, solid phase, covalent attachment, metal-coordination, and electropolymerization. By this they are aware of characterization of MIPs and relevant techniques and can discuss the availability and importance of MIPs as recognition elements in many fields from environmental toxicology to medical diagnostics. The students are also aware of major differences between small and macromolecule imprinting as well as difference between chemical compound and biological target (protein, bacteria, virus, etc) imprinting. They can describe application areas of MIPs, particularly in the areas of biosensors, solid phase extraction, membrane separation technology as well as in catalysis, diagnostics, and drug delivery and release. The students can discuss the impact and motivation of computational programs in molecular imprinting technology and diagnostics. They are able to describe the workflow of computational simulations throughout molecular modelling investigations of targeted compounds (templates) from structure preparation to molecular dynamics evaluations and finding best possible monomer/s and/or crosslinkers for imprinting recipes. They are familiar to several computational programs for virtual screening of a compound of interest to be imprinted and/or diagnosed.			

Content	○ Molecular imprinting technology ○ Molecularly imprinted polymers (MIPs) as bio-inspired functional materials ○ Covalent, semi-covalent and non-covalent imprinting approaches ○ Production methods of MIPs (monolith, precipitation, electropolymerization, solid phase, covalent attachment, metal-coordination) ○ Characterization of MIPs (physical, mechanical and thermal polymer properties, chemical structure of polymers, polymer topography) ○ Recognition elements (MIPs, antibodies, aptamers, peptides)/ Why are MIPs needed in recognition and diagnostics? ○ Major differences between small and large molecule imprinting ○ Application areas of MIPs (diagnostics, imaging, drug delivery, therapy development, separation, purification, catalysis) ○ How does molecular modelling contribute to imprinting technology and diagnostics? ○ Computational programs for virtual screening of bio-inspired functional materials and target molecules ○ How do computational studies match with experimental outputs? How can this match be perfected?
Media	Lectures and computer aided exercises, external resources
Literature	• Z. Altintas (2022). Molecularly Imprinted Polymers: Computational Studies to Advanced Applications. Springer. • Z. Altintas (2018). Biosensors and Nanotechnology - Applications in Health Care Diagnostics. John Wiley & Sons Press. Print ISBN: 9781119065012, Electronic ISBN: 9781119-065173

Module number	**mawi963-01a**			
Module title	**Biosensor Technologies**			
Module level	Deepening Materials Science			
Abbreviation	BioTech			
Subtitle (if applicable)	–			
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Engineering			
Responsible institute	Institute for Materials Science			
Responsible staff member	Prof. Dr. Z. Altintas			
Lecturer	Prof. Dr. Z. Altintas and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory elective subject in term 2. or 4. semester			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration, M.Sc. Materials Science and Engineering			
Evaluation	graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Biosensor Technologies	compulsory	2
	Lab Course	Biosensor Technologies	compulsory	1
	Seminar	Biosensor Technologies	compulsory	1
Workload	60 h lecture 30 h lab course 30 h seminar 90 h self-organized studies 210 h total workload			
Credits	7 ECTS			
Prerequisites according to examination order	none			

Recommended prerequisites	none			
Course related work	none			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Oral or written exam	Compulsory	Graded	50%
	Semester project	Compulsory	Graded	50%
Learning outcome	The students have experiences in discussing the motivation, merits, and challenges in the field of biosensor technologies. They are able to describe the biosensor and their classification and are familiar to receptors and bioassays in biosensors. They can describe the principle of all major biosensor types and the applications of the introduced sensor systems in food, medical, and environmental diagnostics. The students are aware of the importance of surface chemistry development in biosensors. They can determine the appropriate surface chemistry development in biosensors. The students are familiar to the development of a sensor for diagnostic purposes through laboratory practicums.			
Content	○ Biosensor technology ○ Classification of biosensors ○ Receptors in biosensors ○ Assay types in biosensors ○ Surface plasmon resonance (SPR) sensors ○ Quartz crystal microbalance (QCM) sensors ○ Electrochemical sensors (enzyme labelled as well as enzyme-free systems) ○ Lab-on-a-chip sensors ○ Surface chemistry development in biosensors ○ How can we establish most appropriate sensing arrays using conventional and innovative surface chemistry approaches?			
Media	Lectures and computer aided exercises, external resources			
Literature	• Z. Altintas (2018). Biosensors and Nanotechnology - Applications in Health Care Diagnostics. John Wiley & Sons Press. Print ISBN: 9781119065012, Electronic ISBN: 9781119-065173 • Z. Altintas and A. Barhoum (2022). Fundamentals of Sensor Technology. Elsevier. Print ISBN: 9780323884310, Electronic ISBN: 9780323884327. • Z. Altintas and A. Barhoum (2022). Advanced Sensing Technology. Elsevier. Print ISBN: 9780323902229, Electronic ISBN: 9780323902236.			

Compulsory Electives in special topics in Business Administration (SBWL)

The modules in business administration for this study course are grouped by topics in so called SBWL. Each SBWL consists out of several lectures, exercises and seminars. To fulfil one SBWL three parts out of this content must be passed which offer 15 credit points in sum.

20 credit points must be achieved by compulsory electives in business administration. 15 of these credit points must be out of one passed SBWL. The missing 5 credit points must be from lectures or seminars out of other SBWLs.

SBWL Marketing

Marketing-Forschung 103
Cross-Cultural Marketing 105
Marketing Communications 107
Forschungsseminar zum Marketing: Konsumentenverhalten 109
Forschungsseminar zum Marketing: Marketing-Konzeption 111
Forschungsseminar zum Marketing: Sustainability Marketing 113

SBWL Organization

Empirische Organisationsforschung ..... Fehler! Textmarke nicht definiert.
Organization Design ..... Fehler! Textmarke nicht definiert.
Organisationstheorie 120
Internationalization and Organization 123
Unternehmensführung 125
Forschungsseminar zur Organisation 127

SBWL Gründungs- und Innovationsmanagement

Entrepreneurship 129
Innovation Management: Strategies and Actors 132
Cooperation and Networks 134
Forschungsseminar: Entrepreneurship and Innovation Management 136
Forschungsseminar: Cooperation and Networks 138

SBWL Technologiemanagement

Strategic Technology Management 140
Organizing Research and Development 142
Management von Serviceinnovationen 144
Forschungsseminar zum Technologiemanagement: Strategisches Technologiemanagement 147
Forschungsseminar zum Technologiemanagement: Organizing R&D 149
Forschungsseminar zum Technologiemanagement: Applied Innovation Research 151

SBWL Supply Chain Management

Green Logistics 153
Wertschöpfungsmanagement 155
Supply Chain Management 157
Economics and Management of Global Supply Chains 159
Forschungsseminar zum SCM 161

SBWL Personal und Organisation

Advanced Human Resource Management 163
Organizational Behavior 166
Change Management 168
Applied Research in Organizational Behavior A 170

SBWL Corporate Accounting & Business Taxation

Steuern und Rechtsformen 172
Grundlagen der Internationalen Unternehmensbesteuerung 174
Steuerplanung und Steuerwirkung 176
Forschungsseminar zur Steuerwirkungsanalyse 178
Forschungsseminar Unternehmensrechnung und Unternehmensbesteuerung 180

SBWL Service Analytics

Revenue Management 182
Advanced Business Analytics 184
Service Operations Management 187
Research Seminar: Service Analytics 189

SWBL	**Marketing**			
Module number	**BWL-MarkFor**			
Module title	**Marketing-Forschung**			
Module level	Deepening Business Administration			
Abbreviation	BWL-MarkFor			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. S. Hoffmann			
Lecturer	Prof. Dr. S. Hoffmann and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Marketing-Forschung	compulsory	2
	Exercises	Marketing-Forschung	compulsory	1
Workload	30 h lecture 15 h exercises 105 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	The composition of the module examination will be announced at the beginning of the semester.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Marketing-Forschung	Compulsory	Graded	100%
Learning outcome	Die Studierenden lernen die Grundlagen der Marktforschung kennen und verstehen. Sie können Versuchspläne kritisch bewerten. Sie verstehen die Voraussetzungen und Gütekriterien verschiedener Analyseverfahren und können verschiedene multivariate Analyseverfahren bei konkreten Anwendungsfällen einsetzen. Sie erlernen die Anwendung der Analysesoftware SPSS.			
Content	Die Vorlesung führt in die Methoden der Marketing-Forschung und in die Analysesoftware SPSS ein. Es wird vermittelt, wie Marktforschungsprojekte geplant und das Instrumentarium sachgerecht eingesetzt werden können, um Marketing-Management-Entscheidungen durch die geeignete Informationsgrundlage zu unterstützen. Die Vorlesung führt zunächst in allgemeine Grundlagen der quantitativen Marketing-Forschung ein (z.B. Testtheorie). Anschließend werden verschiedene multivariate Analysemethoden besprochen (z.B. Regressionsanalyse, Faktorenanalysen, Strukturgleichungsmodelle). In der Übung wird der Umgang mit statistischer Analysesoftware (v.a. SPSS) eingeübt und in einer Projektarbeit angewandt.			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Will be announced at the beginning of the course.			

SWBL	**Marketing**			
Module number	**bwlCrossCulMark-01a**			
Module title	**Cross-Cultural Marketing**			
Module level	Deepening Business Administration			
Abbreviation	bwlCrossCulMark-01a			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. S. Hoffmann			
Lecturer	Prof. Dr. S. Hoffmann and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/Compulsory elective*	*SWS*
	Lecture	Cross-Cultural Marketing	compulsory	2
	Exercises	Cross-Cultural Marketing	compulsory	1
Workload	30 h lecture 15 h exercises 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			

Prerequisites according to examination order	None			
Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	The composition of the module examination will be announced at the beginning of the semester.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Cross-Cultural Marketing	Compulsory	Graded	100%
Learning outcome	Students understand the specifics of marketing in international business. They understand the importance of cultural differences for the design of the marketing mix and can apply cultural concepts to adapt marketing concepts to different country markets. Students can make standardization/differentiation decisions and apply comparative research methods to evaluate country markets comparatively.			
Content	The lecture shows the specifics of marketing in international business activities and teaches how standardization/differentiation (S/D) decisions can be made and how marketing instruments can be successfully adapted to different country markets. In the exercise, the S/D decision is discussed using case studies. The lecture focuses on the standardization/differentiation debate and the conceptualization of culture (e.g. Hofstede, GLOBE). Students learn how product, pricing, distribution and communication policies can be adapted to different country markets and cultures. The basics of comparative research will be taught in the lecture and deepened in the exercise with the help of case studies.			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Will be announced at the beginning of the lecture.			

SWBL	**Marketing**			
Module number	**BWL-MarkComm**			
Module title	**Marketing Communications**			
Module level	Deepening Business Administration			
Abbreviation	BWL-MarkComm			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. S. Hoffmann			
Lecturer	Prof. Dr. S. Hoffmann and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Marketing Communications	compulsory	2
	Exercises	Marketing Communications	compulsory	1
Workload	30 h lecture 15 h exercises 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	The composition of the module examination will be announced at the beginning of the semester.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Marketing Communications	Compulsory	Graded	100%
Learning outcome	Die Studierenden lernen verschiedene Kommunikationsstrategien und –techniken kennen und anzuwenden. Sie können verschiedene kommunikative Maßnahmen vor dem Hintergrund kognitions- und sozialpsychologischer Theorien bewerten, auf die Kommunikationsziele hin maßschneidern und neue Methoden entwickeln. Sie lernen zudem Methoden der Werbewirkungsforschung kennen und anzuwenden.			
Content	The lecture shows how students can develop communication strategies and use the marketing instruments appropriately to ensure the success of the company's communication with its environment in all phases of the product life cycle. The interactive exercise also serves to develop communication skills. The lecture focuses on the psychological and communication-theoretical basics of influencing strategies that companies use in the context of their communication policy (in advertising, sales promotion, public relations, internet communication, direct communication, complaint management, sponsoring). Furthermore, the event will deal with the conceptual and conceptual basics as well as the practice of corporate communication policy and advertising effectiveness research.			
Media	Lectures and computer aided exercises, external resources			
Literature	Will be announced at the beginning of the lecture.			

SWBL	**Marketing**			
Module number	**BWL-FSem1Mark**			
Module title	**Forschungsseminar zum Marketing: Konsumentenverhalten**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSEM1Mark			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Irregular			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. S. Hoffmann			
Lecturer	Prof. Dr. S. Hoffmann and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar zum Marketing: Konsumentenverhalten	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	The module “Marketing-Forschung” should be passed.			
Course related work	None			
Examination(s)	The composition of the module examination will be announced at the beginning of the semester.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Konsumenten-verhalten	Compulsory	Graded	100%
Learning outcome	Studierende sind in der Lage, auf Basis der Theorien des Konsumentenverhaltens Forschungsfragen und Hypothesen zu entwickeln, Methoden der Konsumentenverhaltensforschung eigenständig anzuwenden und diese zur Prüfung der Hypothesen einzusetzen. Sie lernen, mit Hilfe von qualitativen und/oder quantitativen Methoden empirische Daten zu erheben und auszuwerten sowie die Befunde zu interpretieren, zu dokumentieren und zu präsentieren. Sie vertiefen dabei ihre methodischen und kommunikativen Kenntnisse und Fähigkeiten.			
Content	In diesem Seminar wird das theoretische und methodische Wissen in einem ausgewählten Bereich des Marketings des Konsumentenverhaltens vertieft und auf eine konkrete Fragestellung hin angewandt. Verschiedene Methoden der empirischen Marketingforschung Konsumentenverhaltensforschung kommen zum Einsatz und Implikationen für das Marketing-Management werden abgeleitet. Das interaktive und forschungsorientierte Seminar dient auch der Weiterentwicklung der kommunikativen Fähigkeiten. Studenten bearbeiten eigenständig in Gruppen ein Thema aus dem Bereich Marketing Konsumentenverhalten (z.B. Nachhaltigkeitsmarketing, Interkulturelles Marketing, Kommunikationspolitikkollaborativer Konsum, ethischer Kon-sum, gesundheitsbewusster Konsum, Geltungskonsum etc.). Sie führen eine eigene Erhebung durch. Sie stellen ihre Befunde und Implikationen in einer mündlichen Präsentation vor, die anschließend diskutiert wird.			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Will be announced at the beginning of the course.			

SWBL	**Marketing**			
Module number	**BWL-FSem2Mark**			
Module title	**Forschungsseminar zum Marketing: Marketing-Konzeption**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSEM2Mark			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Irregular			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. S. Hoffmann			
Lecturer	Prof. Dr. S. Hoffmann and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar zum Marketing	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	The module “Marketing-Forschung” should be passed.			

Course related work	None			
Examination(s)	The composition of the module examination will be announced at the beginning of the semester.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Marketing-Konzeption	Compulsory	Graded	100%
Learning outcome	Studierende sind in der Lage, Methoden der Marketing-Forschung eigenständig anzuwenden und diese zur Analyse einer Fragestellung des ausgewählten Bereichs des Marketings einzusetzen. Sie lernen, empirische Daten zu erheben und auszuwerten sowie die Befunde zu interpretieren und darauf aufbauend Marketing-Konzeptionen zu entwickeln sowie dieses zu dokumentieren und zu präsentieren. Sie vertiefen dabei ihre methodischen und kommunikativen Kenntnisse und Fähigkeiten.			
Content	In diesem Seminar wird das konzeptionelle, theoretische und methodische Wissen in einem ausgewählten, aktuellen Bereich des Marketings vertieft und auf eine konkrete Fragestellung hin angewandt. Verschiedene Methoden der empirischen Marketingforschung kommen zum Einsatz und Implikationen zur Entwicklung von Marketing-Konzeptionen werden abgeleitet. Das interaktive und forschungsorientierte Seminar dient auch der Weiterentwicklung der kommunikativen Fähigkeiten. Studenten bearbeiten vor dem Hintergrund gesellschaftlicher Trends (z.B. Digitalisierung, Klimawandel, Globalisierung) eigenständig in Gruppen ein Thema aus dem Bereich Marketing (z.B. digitales Marketing, Nachhaltigkeitsmarketing, interkulturelles Marketing etc.). Sie führen eine eigene Erhebung durch. Sie stellen ihre Befunde und Implikationen in einer mündlichen Präsentation vor, die anschließend diskutiert wird.			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Will be announced at the beginning of the course.			

SWBL	**Marketing**			
Module number	**BWL-FSem3Mark**			
Module title	**Forschungsseminar zum Marketing: Sustainability Marketing**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSEM3Mark			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Irregular			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. S. Hoffmann			
Lecturer	Prof. Dr. S. Hoffmann and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar zum Marketing: Sustainability Marketing	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	The module “Marketing-Forschung” should be passed.			
Course related work	None			
Examination(s)	The composition of the module examination will be announced at the beginning of the semester.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Sustainability Marketing	Compulsory	Graded	100%
Learning outcome	Studierende sind in der Lage, Methoden der Marketing-Forschung eigenständig anzuwenden und diese zur Analyse einer Fragestellung des ausgewählten Bereichs des Sustainability Marketings einzusetzen. Sie lernen, empirische Daten zu erheben und auszuwerten sowie die Befunde zu interpretieren, zu dokumentieren und zu präsentieren. Sie vertiefen dabei ihre methodischen und kommunikativen Kenntnisse und Fähigkeiten.			
Content	In diesem Seminar wird das theoretische und methodische Wissen in einem ausgewählten Bereich des Sustainability Marketings vertieft und auf eine konkrete Fragestellung hin angewandt. Verschiedene Methoden der empirischen Marketingforschung kommen zum Einsatz und Implikationen für Marketer und Policy Maker das Marketing-Management werden abgeleitet. Das interaktive und forschungsorientierte Seminar dient auch der Weiterentwick-lung der kommunikativen Fähigkeiten. Studenten bearbeiten eigenständig in Gruppen ein Thema aus dem Bereich Sustainability Marketing (z.B. Nachhaltigkeitsmarketing , Interkulturelles Marketing, KommunikationspolitikAttitude-Behavior-Gap, Rebound, Sharing-Economy etc.). Sie führen eine eigene Erhebung durch. Sie stellen ihre Befunde und Implikationen in einer mündli-chen Präsentation vor, die anschließend diskutiert wird.			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Will be announced at the beginning of the course.			

SWBL	**Marketing**			
Module number	**BWL-FSem4Mark**			
Module title	**Forschungsseminar zum Marketing: Angewandte Marketing-Forschung**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSEM4Mark			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Irregular			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. S. Hoffmann			
Lecturer	Prof. Dr. S. Hoffmann and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar zum Marketing: Angewandte Marketing-Forschung	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	The module “Marketing-Forschung” should be passed.			

Course related work	None			
Examination(s)	The composition of the module examination will be announced at the beginning of the semester.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Angewandte Marketing-Forschung	Compulsory	Graded	100%
Learning outcome	Studierende sind in der Lage, Methoden der Marketing-Forschung eigenständig anzuwenden und diese zur Analyse einer Fragestellung des ausgewählten Bereichs des Marketings einzusetzen. Sie lernen, empirische Daten zu erheben und auszuwerten sowie die Befunde zu interpretieren, zu dokumentieren und zu präsentieren. Sie vertiefen dabei ihre methodischen und kommunikativen Kenntnisse und Fähigkeiten.			
Content	In diesem Seminar wird das theoretische und methodische Wissen in einem ausgewählten Bereich des Marketings vertieft und auf eine konkrete Fragestellung hin angewandt. Verschiedene Methoden der empirischen Marketingforschung kommen zum Einsatz und Implikationen für das Marketing-Management werden abgeleitet. Das interaktive und forschungsorientierte Seminar dient auch der Weiterentwicklung der kommunikativen Fähigkeiten. Studenten bearbeiten eigenständig in Gruppen ein Thema aus dem Bereich Marketing (z.B. Gesundheitsmarketing, Interkulturelles Marketing, Kommunikationspolitik etc.). Sie führen eine eigene Erhebung durch. Anschließend ver-fassen sie eine Seminararbeit und stellen diese in einer mündlichen Präsentation vor, die anschließend diskutiert wird			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Will be announced at the beginning of the course.			

SWBL	**Organization**			
Module number	**BWL-IntOrgII**			
Module title	**Internationalization and Organization II**			
Module level	Deepening Business Administration			
Abbreviation	BWL-IntlOrgII			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. Dr. h.c. J. Wolf			
Lecturer	Prof. Dr. Dr. h.c. J. Wolf and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Internationalization and Organization II	compulsory	2
	Exercises	Internationalization and Organization II	compulsory	1
Workload	30 h lecture (15 hours per SWS) 15 h exercises (15 hours per SWS) 105 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Internationalization and Organization II	Compulsory	Graded	100%
Learning outcome	The students gain competencies to reflect companies' international business activities critically. They have research competency in self-management and decision-making.			
Content	This lecture extends and specifies the topics presented and discussed in the lecture "Internationalization and Organization I" (Summer term). In the lecture "Internationalization and Organization II" we will focus on cultural, strategic and organizational questions related to companies' international business activities. First, we will study how to conceptualize and how to empirically study the culture of foreign countries. Then, we will focus on strategic aspects (strategic orientations of international companies; configuration of their value chain) of international companies. In the chapters "Organization of international companies" we will focus on structural and non-structural organizational adaptations necessary during the internationalization process of companies. Topics: • Conceptual and methodological approaches to country culture • Strategies of international companies • Organization of international companies I: Archetypes of macro structures • Organization of international companies II: Empirical studies referring to strategy and structure of international companies • Organization of international companies III: Technocratic and person-oriented coordination of international companies • Strategies and Instruments of International Human Resource Management			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• Adler, N. J., International Dimensions of Organizational Behavior, 5th ed., Cincinnati 2007. • Bartlett, C. A., Beamish, P., Transnational Management – Text, Cases, and Readings in Cross Border Management, 7th ed., Boston et al. 2013. • Bartlett, C. A., Ghoshal, S., Managing Across Borders – The Transnational Solution, 2nd ed., Boston 1998.			

	• Hill, C. W. L., International Business – Competing in the Global Marketplace, 11th ed., New York 2017. • Cavusgil, S. T., Knight, G., Riesenberger, J. R., International Business – The New Realities, 4th ed., Boston 2017. Denzin, Norman K. und Yvonna Lincoln (Hrsg.): The SAGE Handbook of Qualitative Research. 3. Aufl., Thousand Oaks 2005.

SWBL	**Organization**			
Module number	**BWL-SchlOrga**			
Module title	**Organisationstheorie**			
Module level	Deepening Business Administration			
Abbreviation	BWL-SchlOrga			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term (irregular)			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. Dr. h.c. J. Wolf			
Lecturer	Prof. Dr. Dr. h.c. J. Wolf and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Organisationstheorie	compulsory	2
	Exercises	Organisationstheorie	compulsory	1
Workload	30 h lecture 15 h exercises 105 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Organisationstheorie	Compulsory	Graded	100%
Learning outcome	Die Studierenden kennen die Erklärungsformen und Argumentationsfiguren unterschiedlicher Organisationstheorien, so dass sie institutionelle und instrumentelle Aspekte der Organisation von Unternehmen erklären können. Die Studierenden vermögen institutionelle und instrumentelle Aspekte der Organisation von Unternehmen kritisch zu reflektieren.			
Content	• In dieser Lehrveranstaltung setzen sich die Studierenden mit den Argumentationsfiguren unterschiedlicher Organisationstheorien auseinander. Diese Beschäftigung mit Organisationstheorien wird es den Studierenden ermöglichen, die für bestimmte Organisationsgestaltungs-Probleme geeignete(n) Organisationstheorie(n) auszuwählen und zielführend anzuwenden. Die Studierenden werden in der Lage sein, die Organisationstheorien mit dem zu lösenden Organisationsgestaltungs-Problem zu verknüpfen. Die Lehrveranstaltung richtet sich auch an Studierende, die auf der Suche nach einer für ein organisations- und managementwissenschaftliches Forschungsprojekt geeigneten Theorie sind. Die Darstellung und Diskussion der Organisationstheorien erfolgt auf einem für ein Masterstudium angemessenen Niveau. Die Lernziele dieser Lehrveranstaltung werden auf dem Wege eines Literaturstudiums sowie einer teilnehmerseitigen Diskussion der präsentierten Organisationstheorien erreicht. • Theorien, Ansätze, Paradigmen und Denkschulen und deren Bedeutung für den Wissenschaftsbetrieb • Inhalt von Theorien / Stufen der Theoriebildung / An Theorien zu richtende Mindestanforderungen / Paradigmen und Denkschulen / Erklärende vs. verstehende Wissenschaft • Fundamente der Organisationstheorie • Systemtheorie / Situationstheorie / verhaltenswissenschaftliche Theorie / Macht- und Ressourcenabhängigkeitstheorie • Aktuelle Entwicklungslinien der Organisationstheorie • Informationsverarbeitungsansatz / Neue Institutionenökonomische Theorie / Evolutionstheorie / Selbstorganisationstheorie / Gestaltansatz / Interpretationsansatz / Institutionalistischer Ansatz / Ressourcenbasierter Ansatz / Pfadabhängigkeitstheorie			

	• Konzepte zur inhaltlichen Systematisierung von Organisationstheorien
Media	Blackboard, lecture notes Digital presentation (available in the internet)
Literature	• Wolf, Joachim: Organisation, Management, Unternehmensführung – Theorien, Praxisbeispiele und Kritik, 5. Auflage, Wiesbaden 2012. • Burrell, Gibson und Gareth Morgan: Sociological Paradigms and Organizational Analysis. Aldershot 1992.

SWBL	**Organization**			
Module number	**BWL-IntlOrga**			
Module title	**Internationalization and Organization**			
Module level	Deepening Business Administration			
Abbreviation	BWL-IntlOrga			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. Dr. h.c. J. Wolf			
Lecturer	Prof. Dr. Dr. h.c. J. Wolf and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Internationalization and Organization	compulsory	2
	Exercises	Internationalization and Organization	compulsory	1
Workload	30 h lecture 15 h exercises 105 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Internationalization and Organization	Compulsory	Graded	100%
Learning outcome	The participants have knowledge about the most central management-oriented decision topics associated with companies' business internationalization. The participants are able to discuss and reflect the most central management-oriented decision topics associated with companies' business internationalization.			
Content	During the last decade international business, activities have not only increased in volume but have also changed in their kinds. Due to the increasing transfer of production as well as research and development activities to different countries, questions of strategy, organization and cross-cultural management have increased in importance. This course teaches management and organization theories and concepts useful for designing both traditional and new forms of international business activities. • Quantitative and qualitative trends in the international business environment • Modes of foreign market entry • Theoretical approaches for the explanation of different modes of foreign market entry • Conceptual and methodological approaches to country culture			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• Adler, N. J., International Dimensions of Organizational Behavior, 5th ed., Cincinnati 2007. • Bartlett, C. A., Beamish, P., Transnational Management – Text, Cases, and Readings in Cross Border Management, 8th ed., Boston et al. 2018. • Bartlett, C. A., Ghoshal, S., Managing Across Borders – The Transnational Solution, 2nd ed., Boston 1998. • Hill, C. W. L., Hult, G. T. M., International Business – Competing in the Global Marketplace, 12th ed., New York 2018. • Cavusgil, S. T., Knight, G., Riesenberger, J. R., International Business – The New Realities, 4th ed., Boston 2017.			

SWBL	**Organization**			
Module number	**BWL-UntFhrg**			
Module title	**Unternehmensführung**			
Module level	Deepening Business Administration			
Abbreviation	BWL-UntFhrg			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term (irregular)			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. Dr. h.c. J. Wolf			
Lecturer	Prof. Dr. Dr. h.c. J. Wolf and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Unternehmensführung	compulsory	2
	Exercises	Unternehmensführung	compulsory	1
Workload	30 h lecture 15 h exercises 105 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Unternehmens-führung	Compulsory	Graded	100%
Learning outcome	Die Studierenden können übergeordnete, das Gesamtunternehmen betreffende Führungsentscheidungen nachvollziehen und erklären. Die Studierenden vermögen übergeordnete, das Gesamtunternehmen betreffende Führungsentscheidungen kritisch zu reflektieren.			
Content	Die Studierenden lernen Strategien und Konzepte zur Führung und Organisation von Unternehmen kennen. Das Spektrum behandelter Fragestellungen entstammt dem Bereich Grundlagen der Unternehmensführung, Unternehmensverfassung und Corporate Governance, Entwicklung von Unternehmenszielen und -grundsätzen, Formulierung von Strategien, Strategien und Organisationsformen internationaler Unternehmen, Interkulturelle Unternehmensführung, Entscheidungsprozesse in der Unternehmensrealität sowie Gestaltungskonzepte der Unternehmensführung. • Unternehmens-Umwelt-Koordination als Kernaufgabe der Unternehmensführung • Unternehmensverfassung und Corporate Governance • Entwicklung von Unternehmenszielen und -grundsätzen • Formulierung von Strategien • Strategien und Organisationsformen internationaler Unternehmen • Interkulturelle Unternehmensführung • Entscheidungsprozesse in der Unternehmensrealität • Gestaltungskonzepte der Unternehmensführung			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• Macharzina, K. und Joachim Wolf: Unternehmensführung – Das internationale Managementwissen – Konzepte, Methoden, Praxis. 9. Aufl., Wiesbaden 2015.			

SWBL	**Organization**			
Module number	**BWL-FSem1Orga**			
Module title	**Forschungsseminar zur Organisation**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSem1Orga			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. Dr. h.c. J. Wolf			
Lecturer	Prof. Dr. Dr. h.c. J. Wolf and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar zur Organisation	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	None			

Course related work	None			
Examination(s)	Seminar work with presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Forschungsseminar zur Organisation	Compulsory	Graded	100%
Learning outcome	Die Studierenden verfügen über vertiefte Kenntnisse, die einen aktuellen, inhaltlich schwierigeren Teilbereich des Managements von Unternehmen betreffen. Die Studierenden haben durch eine selbständige Bearbeitung einer managementorientieren Themenstellung ihre Methodenkompetenzen (Techniken wissenschaftlichen Arbeitens, Vortragstechniken, Medienfertigkeiten) erweitert.			
Content	Die Studierenden fertigen selbstständig eine Hausarbeit zu einem Thema an und tragen diese im Seminar vor. Neben fortgeschrittenen Aspekten der Organisationswissenschaft werden die Grundlagen des wissenschaftlichen Arbeitens vermittelt und Vortragstechniken eingeübt werden. Damit sollen die Grundlagen für die Master-Arbeit, das weitere Studium der Betriebswirtschaftslehre und eine qualifizierte Tätigkeit im Berufsfeld eines Organisationsspezialisten gelegt werden. Wechselnde Themen aus dem Gebiet der Organisationslehre, wie z.B. • Organisation virtueller Unternehmen • Organisation internationaler Unternehmen • Kernkompetenzorientierte organisatorische Gestaltung • Organisationstheoretische Konzepte und deren Bedeutung für die Unternehmenspraxis • Landeskulturen und interkulturelles Training • Spitzenführungskräfte und deren Einfluss auf Unternehmensstrategien			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Will be announced at the beginning of the course.			

SWBL	**Gründungs- und Innovationsmanagement**			
Module number	**BWL-Entre2**			
Module title	**Entrepreneurship**			
Module level	Deepening Business Administration			
Abbreviation	BWL-Entre2			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. A. Walter			
Lecturer	Prof. Dr. A. Walter and staff			
Teaching language	German (slides and literature are in English)			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Entrepreneurship	compulsory	2
	Exercises	Entrepreneurship	compulsory	1
Workload	30 h lecture 15 h exercises 105 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written or oral examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Entrepreneurship	Compulsory	Graded	100%
Learning outcome	Die Studierenden sollen theoretisches Wissen, vor allem aber auch Methoden und Instrumente des Entrepreneurships kritisch reflektieren und gezielt zur Lösung von Problemstellungen einsetzen können: • Kennen und verstehen von theoretischen Konzepten sowie praxisrelevantem Wissen zum Entrepreneurship. • Analysieren von Best Practices im Entrepreneurship anhand von Fallstudien und Gastvorträgen. • Anwenden des theoretischen und praxisrelevanten Wissens bei der eigenständigen Entwicklung von Geschäftsmodellen für technologiebasierte Geschäftsideen.			
Content	Die Freiheit des internationalen Warenverkehrs geht einher mit einer Verschärfung des Wettbewerbs, die ihrerseits Technologie- und Produktlebenszyklen verkürzte. Im Ergebnis steht eine Umwelt, die von zunehmender Dynamik und Komplexität geprägt ist. Einerseits bedingt diese Entwicklung das Absterben bzw. die Verlagerung ganzer Industriezweige, andererseits weckt sie neue Bedürfnisse, bringt neue technologische Möglichkeiten hervor und schafft neue Märkte. Vor diesem Hintergrund ist es Ziel der Vorlesung, Denkansätze und Methoden der Identifikation von technologiebasierten Geschäftschancen, der Bewertung von Märkten und Markteintrittsstrategien sowie der Entwicklung technologiebasierter Neugründungen und Jungunternehmen zu vermitteln. Der Kurs behandelt die folgenden Schwerpunktthemen: • Grundlegende Entrepreneurship-Theorien und Rolle des Entrepreneurs • Business Model Canvas – Aufbau, Erklärung und Beispiele • Theoretische Grundlagen eines nachhaltigen Wettbewerbsvorteils im Kontext einer Unternehmensgründung • Identifikation und Bewertung technologiebasierter Geschäftschancen • Kundenwert und Leistungsversprechen (value proposition) • Markteintrittsstrategien technologiebasierter Start-Ups und Ausgründungen (Spin-Offs, Spin-Outs) • Unternehmerische Orientierung und Unternehmenswachstum			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			

Literature	• Dollinger, M. J., Entrepreneurship: Strategies and Resources, Upper Salle River, N.J., 1999. • Stevenson, H. H., Roberts, M. J., Grousbeck, H. I., Bhidè, A. V., New Business Ventures and the Entrepreneur, Bos-ton, 1999. • Aktuelle Forschungsliteratur zum Entrepreneurship (Syllabus und Textgrundlage werden am Beginn der Veranstaltung bekanntgegeben)

SWBL	**Gründungs- und Innovationsmanagement**			
Module number	**BWL-InnoMStrat**			
Module title	**Innovation Management: Strategies and Actors**			
Module level	Deepening Business Administration			
Abbreviation	BWL-InnoMStrat			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. A. Walter			
Lecturer	Prof. Dr. A. Walter and staff			
Teaching language	German (slides and literature are in English)			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Innovation Management: Strategies and Actors	compulsory	2
	Exercises	Innovation Management: Strategies and Actors	compulsory	1
Workload	20 h lecture (10 hours per SWS) 10 h exercises (10 hours per SWS) 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Innovation Management: Strategies and Actors	Compulsory	Graded	100%
Learning outcome	At the end of the course students will be able to demonstrate understanding, and to make critical assessments of the following: • Assess and interpret innovation strategies • Develop and formulate managerial strategies to shape the performance of inter-organizational relationships and strategic alliances • Utilise tools of innovation management to map and measure innovation performance • Diagnose different innovation challenges and make recommendations for resolving them			
Content	• Definitions and concepts of innovativeness • Innovation radicalness • Innovation strategies • Innovation communication • Innovation championing • Teams in innovation processes			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Selected research and journal articles (comprehensive reading list and essential papers will be provided at the beginning of the course)			

SWBL	**Gründungs- und Innovationsmanagement**			
Module number	**BWL-CoopNet**			
Module title	**Cooperation and Networks**			
Module level	Deepening Business Administration			
Abbreviation	BWL-CoopNet			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. A. Walter			
Lecturer	Prof. Dr. A. Walter and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Cooperation and Networks	compulsory	2
	Exercises	Cooperation and Networks	compulsory	1
Workload	20 h lecture (10 hours per SWS) 10 h exercises (10 hours per SWS) 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Cooperation and Networks	Compulsory	Graded	100%
Learning outcome	At the end of the course students will be able to demonstrate understanding and to make critical assessments of the following: • Assess and interpret cooperation processes • Develop and formulate managerial strategies to shape the performance of inter-organizational relationships and strategic alliances • Utilise tools of relationship and network management to map and measure collaborative activities • Diagnose different cooperation challenges and make recommendations for resolving them			
Content	• Definitions and the concept of embeddedness • Collaborative value creation and relationship outcomes • Inter-organizational governance • Inter-organizational relationship models • Cooperation in strategic alliances • Network capability and relationship championing			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Journal articles			

SWBL	**Gründungs- und Innovationsmanagement**			
Module number	**bwlResSemGuI1-01a**			
Module title	**Forschungsseminar: Entrepreneurship and Innovation Management**			
Module level	Deepening Business Administration			
Abbreviation	bwlResSemGuI1-01a			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Irregular			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. A. Walter			
Lecturer	Prof. Dr. A. Walter and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar: Entrepreneurship and Innovation Management	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	None			
Examination(s)	Homework with presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Entrepreneurship and Innovation Management	Compulsory	Graded	100%
Learning outcome	Die Studierenden sollen aktuelle wissenschaftliche Konzepte des Gründungs- und Innovationsmanagements kennen und verstehen. Darüber hinaus kennen die Studierenden zentrale wissenschaftliche Forschungsmethoden und können diese anwenden. Sie sind in der Lage, die Zusammenhänge von Theorie, Konzeption und Methodik zu erkennen und wissenschaftliche Fragestellungen zu analysieren. Die Studierenden erwerben wissenschaftliche Präsentations- und Diskussionskompetenz.			
Content	In diesem Modul werden im Rahmen wechselnder Oberthemen spezifische Fragestellungen aus dem Gründungs- und Innovationsmanagement anhand der grundlegenden und der jüngsten wissenschaftlichen Literatur erarbeitet.			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Topic orientated			

SWBL	**Gründungs- und Innovationsmanagement**			
Module number	**bwlResSemGuI2-01a**			
Module title	**Forschungsseminar: Cooperation and Networks**			
Module level	Deepening Business Administration			
Abbreviation	bwlResSemGuI2-01a			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Irregular			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. A. Walter			
Lecturer	Prof. Dr. A. Walter and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar: Cooperation and Networks	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	None			

Course related work	None			
Examination(s)	Homework with presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Cooperation and Networks	Compulsory	Graded	100%
Learning outcome	Die Studierenden sollen aktuelle wissenschaftliche Konzepte des Gründungs- und Innovationsmanagements kennen und verstehen. Darüber hinaus kennen die Studierenden zentrale wissenschaftliche Forschungsmethoden und können diese anwenden. Sie sind in der Lage, die Zusammenhänge von Theorie, Konzeption und Methodik zu erkennen und wissenschaftliche Fragestellungen zu analysieren. Die Studierenden erwerben wissenschaftliche Präsentations- und Diskussionskompetenz.			
Content	In diesem Modul werden im Rahmen wechselnder Oberthemen spezifische Fragestellungen aus dem Gründungs- und Innovationsmanagement anhand der grundlegenden und der jüngsten wissenschaftlichen Literatur erarbeitet.			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	Topic orientated			

SWBL	**Technologiemanagement**			
Module number	**BWL-StraTechM**			
Module title	**Strategic Technology Management**			
Module level	Deepening Business Administration			
Abbreviation	BWL-StraTechM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Schultz			
Lecturer	Prof. Dr. C. Schultz and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Strategic Technology Management	compulsory	2
	Exercises	Strategic Technology Management	compulsory	1
Workload	20 h lecture (10 hours per SWS) 10 h exercises (10 hours per SWS) 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			

Prerequisites according to examination order	None			
Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Strategic Technology Management	Compulsory	Graded	100%
Learning outcome	Die Studierenden können die Relevanz technologischer Innovationen für die strategische Positionierung von Unternehmen reflektieren und ausgewählte Instrumente der Strategieentwicklung und Strategieimplementierung anwenden.			
Content	Es werden die sich aus der Dynamik der technologischen Entwicklung entstehenden strategischen Herausforderungen diskutiert und geeignete Instrumente für die Definition und Umsetzung von Technologien vermittelt. Folgende Inhalte werden behandelt: • Relevanz Technologiemanagement und Typen von Technologien • Technologie- und Industriedynamik • Technologiestrategie • Strategische Frühaufklärung • Technologie Sourcing • Schutzstrategien			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• M. Schilling (2013) Strategic management of technological innovation McGraw Hill, 3rd edition • In der Vorlesung behandelte Journalartikel			

SWBL	**Technology Management**			
Module number	**BWL-OrgaRnD**			
Module title	**Organizing Research and Development**			
Module level	Deepening Business Administration			
Abbreviation	BWL-OrgaRnD			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Schultz			
Lecturer	Prof. Dr. C. Schultz and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Organizing R&D	compulsory	2
	Exercises	Organizing R&D	compulsory	1
Workload	20 h lecture (10 hours per SWS) 10 h exercises (10 hours per SWS) 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Organizing R&D	Compulsory	Graded	100%
Learning outcome	Den Studierenden kennen die Möglichkeiten zur Analyse von Problemstellungen der Durchführung von Forschung und Entwicklung und deren organisatorische Alternativen. Sie haben die Kompetenz um F&E Portfolios und Technologieprogramme systematisch zu managen, wobei neben Unternehmen auch Forschungsinstitutionen im Fokus stehen.			
Content	Der Schwerpunkt der Veranstaltung liegt auf den Anforderungen der organisatorischen Verankerung von F&E Aktivitäten und der Ausgestaltung von F&E Abteilungen. Folgende Themen werden behandelt: Kontext • Organizational Ambidexterity • Radikale vs. inkrementelle Innovationen • Core Competences vs. Willingness to cannibalize • Closed vs. Open Innovation Strukturgestaltung • Formalisierung und Autorität • Zentralisierung und Dezentralisierung der F&E • Technologieportfolios und –plattformen • Projektbasierte Organisation • Kooperation & Globalisierung Prozessgestaltung • Portfolio- und Programmmanagement von F&E Vorhaben • Verhalten von F&E Mitarbeitern • Wissensmanagement F&E Management von Forschungsinstitutionen • Herausforderungen und moderne Ansätze • Universitäts-Industrie-Kooperationen			
Media	Blackboard, lecture notes Digital presentation (available in the internet)			
Literature	• Hauschildt/Salomo (2007) Innovationsmanagement, 4. Auflage, Kapitel 3 • Schilling (2010) Strategic Management of Technological Innovation, 3rd ed., chapter 6 & 10 • Tidd / Bessant (2009) Managing Innovation 4th ed., chapter 3 & 4 • Hazelkorn (2005) University Research Management Developing Research in New Institutions, OECD			

SWBL	**Technology Management**			
Module number	**BWL-ManSrvi**			
Module title	**Management von Serviceinnovationen**			
Module level	Deepening Business Administration			
Abbreviation	BWL-ManSrvi			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Schultz			
Lecturer	Prof. Dr. C. Schultz and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Management von Serviceinnovationen	compulsory	2
	Exercises	Management von Serviceinnovationen	compulsory	1
Workload	20 h lecture (10 hours per SWS) 10 h exercises (10 hours per SWS) 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	The composition of the module examination will be announced at the beginning of the semester.			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Management von Serviceinnovationen	Compulsory	Graded	100%
Learning outcome	Die Studierenden können die theoretischen Grundlagen von Dienstleistungen wiedergeben und erläutern. Sie können das Phänomen „Servitization“ und „Service Economy“ beschreiben und erklären und die damit verbundenen betriebswirtschaftlichen Herausforderungen für Unternehmen verschiedener Bereiche verdeutlichen. Sie können wesentliche Innovationsbarrieren bei Dienstleistungen beschreiben und deren Unterschiede zu Produktinnovationen erklären. Sie können die Rolle des Service Engineering für die Dienstleistungsentwicklung beschreiben und erläutern, welche Poten-ziale und Vorteile sich durch eine systematische Entwicklung und Gestaltung von Dienstleistungen ergeben. Sie können die notwendigen Rahmenbedingungen für eine hohe Dienstleistungs-Qualität beschreiben und diese auf den Bereich datenbasierter (digitaler) Dienstleistungen anwenden. Sie können mit Hilfe von verschiedenen Modellen die Adoption und Diffusion von Dienstleistungen inhaltlich erklären und relevante Markteintrittsstrategien ableiten.			
Content	Digitale Dienstleistungen dominieren heute die Innovationstätigkeit. Sowohl reine Dienstleister als auch produzierende Unternehmen stehen daher vor der Herausforderung Dienstleistungen systematisch zu entwickeln und im Markt einzuführen. Das Modul widmet sich diesen Herausforderungen und den für die Dienstleistungsentwicklung notwendigen Managementansätzen. Dabei stehen digitale Dienstleistungen, datenbasierte Dienstleistungen und Dienstleistungsplattformen im Fokus der Veranstaltung. Folgende Kapitel werden in der Vorlesung behandelt: • Grundlagen und Besonderheiten von Dienstleistungen • Service Engineering • Nutzerintegration / User Innovation • Modellierung von Dienstleistungen • Dienstleistungsqualität • Adoption und Diffusion von Dienstleistungen • Erfolgsfaktoren von Dienstleistungsinnovationen • Dienstleistungsstrategie & Servitization In der begleitenden Übung führen die Studierenden im Team ein eigenes Dienstleistungs-Innovationsprojekt durch, welches die Phasen von der Anforderungsanalyse bis zur Konzeption von Geschäftsmodellen und Serviceprozessen umfasst. Anhand des			

	Projektes lernen die Studierenden konkrete Instrumente des Service Engineering kennen und reflektieren die Herausforderungen der Dienstleistungsentwicklung.
Media	Blackboard, lecture notes
Literature	• Leimeister, J.M. (aktuelle Ausgabe): Dienstleistungsengineering und –management. Springer und insbesondere die zu den einzelnen Kapiteln benannten wissenschaftlichen Zeitschriftenaufsätze.

SWBL	**Technology Management**			
Module number	**BWL-FSem1TecM**			
Module title	**Forschungsseminar zum Technologiemanagement: Strategisches Technologiemanagement**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSem1TecM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Irregular			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Schultz			
Lecturer	Prof. Dr. C. Schultz and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar zum Technologiemanagement: Strategisches Technologiemanagement	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Module „Strategic Technology Management“ should be passed.			
Course related work	None			
Examination(s)	Homework with presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Strategisches Technologie-management	Compulsory	Graded	100%
Learning outcome	Studierende sind in der Lage, Methoden des Strategischen Technologiemanagement eigenständig anzuwenden und diese zur Analyse einer Fragestellung des ausgewählten Technologiebereichs einzusetzen. Sie lernen, komplexe Sachverhalte zu erschließen, empirische Daten zu erheben und auszuwerten sowie die Befunde zu interpretieren, zu dokumentieren und zu präsentieren. Sie vertiefen dabei ihre methodischen und kommunikativen Kenntnisse und Fähigkeiten. Ziel des Seminars ist die praktische Anwendung von Instrumenten des strategischen Technologiema-nagement. Dabei werden analytische und konzeptionelle fachliche Kompetenzen aufgebaut.			
Content	In diesem Seminar wird das theoretische und methodische Wissen in einem ausgewählten Bereich des Technologie- und Innovationsmanagement vertieft und auf eine konkrete Fragestellung angewandt. Verschiedene Methoden des strategischen Technologiemanagements kommen zum Einsatz und Implikationen für die Praxis werden abgeleitet. Das projektorientierte Seminar dient auch der Weiterentwicklung der Fähigkeiten im Projektmanagement. Im Rahmen des Forschungsseminars werden in Kooperation mit regionalen Unternehmen Szenarioanalysen und Patentanalysen zur Analyse langfristiger Technologie- und Markttrends durchgeführt. Im Rahmen des Seminars werden zunächst Technologie- bzw. Anwendungsfeldsteckbriefe erstellt und darauf aufbauend softwaregestützt Szenarien oder Patentanalysen erarbeitet. Diese sollen in konkrete Strategieempfehlungen für die Unternehmen münden. Die Anwendungsbeispiele werden jeweils mit dem Praxispartner abgestimmt. Die Studierenden bearbeiten eigenständig in Gruppen ein Thema. Sie führen eine eigene Erhebung relevanter Daten durch. Sie stellen ihre Befunde und Implikationen in einer mündlichen Präsentation vor, die anschließend diskutiert wird.			
Media	Blackboard, lecture notes			
Literature	Will be announced at the beginning of the course.			

SWBL	**Technology Management**			
Module number	**BWL-FSem2TecM**			
Module title	**Forschungsseminar zum Technologiemanagement: Organizing R&D**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSem2TecM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Irregular			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Schultz			
Lecturer	Prof. Dr. C. Schultz and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar zum Technologiemanagement: Organizing R&D	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	Module „Organizing R&D “ should be passed.			
Course related work	None			
Examination(s)	Homework with presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Organizing R&D	Compulsory	Graded	100%
Learning outcome	Ziel des Seminars ist der Aufbau von konzeptionellen und methodischen Kompetenzen. Studierende sind in der Lage, Methoden der empirischen Organisations- und Innovationsforschung eigenständig anzuwenden und diese zur Analyse einer Fragestellung einzusetzen. Sie lernen, empirische Daten zu erheben und auszuwerten sowie die Befunde zu interpretieren, zu dokumentieren und zu präsentieren. Sie vertiefen dabei ihre methodischen und kommunikativen Kenntnisse und Fähigkeiten.			
Content	In diesem Seminar wird das theoretische und methodische Wissen in einem ausgewählten Bereich des Technologie- und Innovationsmanagement vertieft und auf eine konkrete Fragestellung angewandt. Verschiedene empirische Methoden kommen zum Einsatz, um Implikationen für die Organisation von Innovation abzuleiten. Das forschungsorientierte Seminar dient auch der Weiterentwicklung der Fähigkeiten in der empirischen Forschung. Bearbeitung einer empirischen Fragestellung anhand von Primär- und Sekundärdaten. Im Rahmen des Forschungsseminars wird eine empirische Fragestellung zur Innovationsfähigkeit von privaten und öffentlichen Unternehmen bearbeitet. Die Studenten wirken an der Studienkonzeption, Datenhebung und Datenanalyse mit. Aufbauend auf einer theoretisch-konzeptionellen Ableitung von Hypothesen, werden diese datengestützt getestet und die Studienergebnisse in einer Seminararbeit zusammengefasst. Dabei kommen primär Methoden der quantitativen Sozialforschung zum Einsatz. Die konkrete Fragenstellung des Seminars wird im Einklang mit dem Forschungsportfolios des Lehrstuhls für Technologiemanagement im Vorfeld festgelegt			
Media	Blackboard, lecture notes			
Literature	References will be announced at the beginning of the course.			

SWBL	**Technology Management**			
Module number	**BWL-FSem3TecM**			
Module title	**Forschungsseminar zum Technologiemanagement: Applied Innovation Research**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSem3TecM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Irregular			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Schultz			
Lecturer	Prof. Dr. C. Schultz and staff			
Teaching language	German			
Assignment to the curriculum	Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar zum Technologiemanagement: Applied Innovation Research	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	At least one module in the topic Technology Management should be passed.			
Course related work	None			
Examination(s)	Homework with presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Applied Innovation Research	Compulsory	Graded	100%
Learning outcome	Ziel des Seminars ist der Aufbau von konzeptionellen und methodischen Kompetenzen. Studierende sind in der Lage, Methoden der empirischen Organisations- und Innovationsforschung und theoretische Inhalte eigenständig anzuwenden und diese auf ein praktisches Problem zu übertragen. Sie lernen empirische Daten zu erheben und auszuwerten sowie die Befunde zu interpretieren, zu dokumentieren und zu präsentieren. Sie vertiefen dabei ihre methodischen und kommunikativen Kenntnisse und Fähigkeiten.			
Content	Im Seminar sollen am konkreten Bespiel ausgewählte Themen der Vorlesungen der Professur für Technologiemanagement vertieft werden, wobei eine empirische Fragestellung anhand von Primär- und Sekundärdaten bearbeitet wird. Eingebettet in aktuelle Forschungsprojekte des Lehrstuhls und in Kooperationen mit der regionalen Wirtschaft bearbeiten die Studierende im Team empirische Forschungsprojekte. In Projekten mit der regionalen Wirtschaft erarbeiten die Studierende im Team innovative Lösungen für die Entwicklung neuer Geschäftsmodelle. Die Themen orientieren Sie sich an den Inhalten der Mastervorlesungen, z.B. Innovationspotenzial in Industrie 4.0, Digitale Services oder Plattforminnovationen. Die Studierenden starten mit einer Analyse des Standes der Forschung, erheben empirische Daten als Primärdatenerhebung, werten diese unter Hinzunahme von Sekundärdaten aus und entwickeln auf dieser Basis Implikationen für die Praxis. Parallel analysieren die Studierenden die Herausforderungen im Rahmen des Innovationsprojektes.			
Media	Blackboard, lecture notes			
Literature	Will be announced at the beginning of the course.			

SWBL	**Supply Chain Management**			
Module number	**BWL-GrnLog**			
Module title	**Green Logistics**			
Module level	Deepening Business Administration			
Abbreviation	BWL-GrnLog			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. F. Meisel			
Lecturer	Prof. Dr. F. Meisel and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Green Logistics	compulsory	2
	Exercises	Green Logistics	compulsory	2
Workload	20 h lecture (10 hours per SWS) 20 h exercises (10 hours per SWS) 110 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Green Logistics	Compulsory	Graded	100%
Learning outcome	Students know the relevant modes of transportation together with their economic and ecologic advantages and disadvantages. They can optimize transportation processes with regard to cost- and service-objectives. The students can estimate the greenhouse gas emissions of transport operations and they can allocate emissions to individual shipments. They can apply various concepts for reducing the environmental footprint of a logistics operation.			
Content	• Introduction to the transport economy • Cost and service oriented logistics planning • Emission oriented transportation planning • Intermodal freight transportation • Location planning and reverse logistics			
Media	Blackboard, lecture notes			
Literature	• Recent papers from scientific journals			

SWBL	**Supply Chain Management**			
Module number	**BWL-WertMan**			
Module title	**Wertschöpfungsmanagement**			
Module level	Deepening Business Administration			
Abbreviation	BWL-WertMan			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. F. Meisel			
Lecturer	Prof. Dr. F. Meisel and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Wertschöpfungsmanagement	compulsory	2
	Exercises	Wertschöpfungsmanagement	compulsory	2
Workload	20 h lecture (10 hours per SWS) 20 h exercises (10 hours per SWS) 110 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Wertschöpfungs-management	Compulsory	Graded	100%
Learning outcome	Die Studierenden haben ein Verständnis für Produktionstheorien und reale Produktionssysteme. Sie kennen relevante Instrumente zur Steigerung der Wirtschaftlichkeit, Produktivität, Qualität und Nachhaltigkeit von Produktionssystemen. Die Studierenden können den Beitrag der vorgestellten Instrumente zum Unternehmenserfolg einschätzen und die vorgestellten Instrumente eigenständig weiterentwickeln und auf reale Problemstellungen anwenden.			
Content	• Theorie der Gütertransformation in Industrieunternehmen • Ausgewählte Aspekte der Beschaffung: z. B. Make-or-Buy Entscheidungen, Bestellmengenplanung, Lieferantenmanagement • Ausgewählte Aspekte der Produktion: z. B. Gestaltung von Produktionssystemen zur Variantenfertigung, Lean Production, Qualitätsmanagement, Ökologieorientierung			
Media	Blackboard, lecture notes			
Literature	• Corsten und Gössinger (2012). Produktionswirtschaft: Einführung in das industrielle Produktionsmanagement, Oldenbourg Verlag, 13. Auflage • Kummer, Grün und Jammernegg (2009). Grundzüge der Beschaffung, Produktion und Logistik. Pearson Verlag, New Jersey, 2. Auflage			

SWBL	**Supply Chain Management**			
Module number	**BWL-SCM**			
Module title	**Supply Chain Management**			
Module level	Deepening Business Administration			
Abbreviation	BWL-SCM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. F. Meisel			
Lecturer	Prof. Dr. F. Meisel and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Supply Chain Management	compulsory	2
	Exercises	Supply Chain Management	compulsory	2
Workload	20 h lecture (10 hours per SWS) 20 h exercises (10 hours per SWS) 110 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Supply Chain Management	Compulsory	Graded	100%
Learning outcome	Die Studierenden haben ein Verständnis für die Potentiale und Herausforderungen einer unternehmensübergreifenden Gestaltung von Wertschöpfungsprozessen. Sie sind befähigt, strategische, taktische und operative Planungsaufgaben des Supply Chain Managements zu modellieren und zu lösen. Die Studierenden können zeitgemäße Managementkonzepte für Supply Chains selbständig auf Fallstudien übertragen und zu deren Lösung einsetzen.			
Content	• Netzwerktheorien zur Entstehung von Supply Chains • Strategische Ausrichtung und Design von Supply Chains • Unternehmensübergreifendes Bestandsmanagement und Contract Design • Risikoreduktion durch Inventory Pooling • Koordinationsinstrumente wie bspw. Vendor Managed Inventory und Kollaborative Planung			
Media	Blackboard, lecture notes			
Literature	• Chopra und Meindl (2009). Supply Chain Management. Prentice Hall, 4. Auflage • Shapiro (2001). Modeling the Supply Chain. Duxbury Press • Simchi-Levi, Kaminski, Simchi-Levi (2007). Designing and Managing the Supply Chain. McGraw Hill, 3. Aufl.			

SWBL	**Supply Chain Management**			
Module number	**BWLVWL-EcoGloSCM**			
Module title	**Economics and Management of Global Supply Chains**			
Module level	Deepening Business Administration			
Abbreviation	BWLVWL-EcoGloSCM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. F. Meisel			
Lecturer	Prof. Dr. F. Meisel, Prof. H. Raff Ph.D. and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Economics and Management of Global Supply Chains	compulsory	2
	Exercises	Economics and Management of Global Supply Chains	compulsory	2
Workload	30 h lecture (10 hours per SWS) 15 h exercises (10 hours per SWS) 135 h self-organized studies 180 h total workload			
Credits	6 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Economics and Management of Global Supply Chains	Compulsory	Graded	100%
Learning outcome	Students are familiar with the most important theories, driving forces, and managerial challenges of global supply chains.			
Content	• Introduction to Global Supply Chain Management • Supplier Network Development • Trade Flows and Transportation Logistics • Volatility in Global Supply Chains • Risk Management			
Media	Blackboard, lecture notes			
Literature	• Head (2007) "Elements of Multinational Strategy" • Recent papers from scientific journals			

SWBL	**Supply Chain Management**			
Module number	**BWL-FSem1SCM**			
Module title	**Forschungsseminar zum SCM**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSem1SCM			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. F. Meisel			
Lecturer	Prof. Dr. F. Meisel and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar zum SCM	compulsory	2
Workload	20 h seminar (10 hours per SWS) 130 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	At least one module on the topic Supply Chain Management should be passed.			
Course related work	None			

Examination(s)	Homework with presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Homework	Compulsory	Graded	50%
	Presentation	Compulsory	Graded	50%
Learning outcome	Die Studierenden können sich durch eine eigenständig durchgeführte Literaturrecherche in den aktuellen Stand eines Forschungsfeldes einarbeiten. Sie sind in der Lage, allein und auch im Team anspruchsvolle Forschungsfragen zu bearbeiten und können ihre gewonnenen Erkenntnisse in einer nachvollziehbaren und sorgfältig verfassten Hausarbeit schriftlich darzulegen. Die Studierenden können ihre gewonnenen Erkenntnisse in verständlichen Vorträgen präsentieren.			
Content	Das Seminar adressiert wechselnde Forschungsthemen aus den Bereichen Supply Chain Management, Produktion, Logistik und Operations Research. Die konkreten Themen eines Seminars werden gesondert angekündigt.			
Media	Blackboard, lecture notes			
Literature	Als Einstiegsquellen werden wissenschaftliche Fachaufsätze aus renommierten, internationalen Zeitschriften im Vorfeld des Seminars bekanntgegeben. Weitere themenrelevante Literatur wird als Bestandteil der Seminararbeit selbständig durch die Studierenden recherchiert.			

SWBL	**Personal und Organisation**			
Module number	**BWLAdvHRM-01a**			
Module title	**Advanced Human Resource Management**			
Module level	Deepening Business Administration			
Abbreviation	BWL- AdvHRM-01a			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Buengeler			
Lecturer	Prof. Dr. C. Buengeler and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Advanced Human Resource Management	compulsory	2
	Tutorial	Advanced Human Resource Management	compulsory	1
Workload	30 h lecture 15 h exercises 105 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Advanced Human Resource Management	Compulsory	Graded	100%
Learning outcome	Students are able to reproduce the arguments underpinning how HRM can be used by organizations to gain a competitive advantage. They describe, compare and evaluate important theories and empirical findings related to (strategic) HRM. The students can describe employee reactions and other outcomes of HRM and can apply the theories and knowledge gained from empirical findings to practical issues and problems. The students can explain and showcase the importance of evidence-based HRM for managerial decision-making.			
Content	This course provides comprehensive knowledge of how Human Resource policies, practices and systems influence employees' behaviour, attitudes and performance and how Human Resource Management can generate a competitive advantage for organizations. Particular emphasis is given to evidence-based Human Resource Management. Students will apply the theories and knowledge gained from empirical findings to practical issues and problems. The course covers three parts: Part 1: Strategic HRM; Theories & Evidence • The importance of Human Resource Management • Best fit vs. best practice vs. HR configurations • Resource-based view & human capital management • HR Roles and the role of line managers • AMO-framework • The Impact on Organizational Performance and Employee Well-being Part 2 – Putting (S)HRM into Effect; HR Policies & Practices • Job Design & HR Planning • Recruitment & Selection • Performance Management • Compensation & Rewards • Training & Development Part 3: Trends, Challenges and Applications • New Forms of Working / Stress and Health Management / Workforce Composition and Non-prototypical Managers • Guest Speaker (tbc)			
Media	Blackboard, lecture notes			

Literature	Selected key articles will be introduced in class; students may be required to search and use additional articles. Additionally: Textbook chapters • Noe, R., Hollenbeck, J., Gerhart, B., & Wright, P. (2017). Human Resource Management: Gaining A Competitive Advantage. Global 10th Edition. Mcgraw-Hill Education.

SWBL	**Personal und Organisation**			
Module number	**BWL-OrgBeh**			
Module title	**Organizational Behavior**			
Module level	Deepening Business Administration			
Abbreviation	BWL- **OrgBeh**			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Buengeler			
Lecturer	Prof. Dr. C. Buengeler and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Organizational Behavior	compulsory	2
	Tutorial	Organizational Behavior	compulsory	1
Workload	30 h lecture 15 h exercises 105 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Organizational Behavior	Compulsory	Graded	100%
Learning outcome	Students are able to describe and discuss central organizational behavior theories. They can showcase conceptual thinking related to OB phenomena. The students describe, discuss, and compare empirical evidence on the phenomena and theories studied and can apply this knowledge to practical questions. They have increase effectiveness in dealing with oneself and others at work.			
Content	This course provides students with comprehensive knowledge of theories and evidence regarding organizational behavior which will enhance their ability and accuracy in explaining and predicting behavior in the workplace. The importance of a systematic study of organizational behavior will be illustrated by discussing and comparing empirical evidence on the phenomena and theories studied. The acquired knowledge will be applied to practical questions and common people management issues. • Attitudes, Job Performance • Moods, Emotions, and Motivation • Personality, Ability • Perceptions, Biases, and Stereotypes • Group Work, • Team Composition, Diversity • Leadership			
Media	Blackboard, lecture notes			
Literature	Primary: • Robbins, Stephen P., Judge, Timothy A. (2014). Organizational Behavior. Global 16th Edition, ISBN 10 129205655X or ISBN 13 9781292056555, Pearson Education. • Colquitt, Jason A., LePine, Jeffery A., Wesson, Michael J. (2020). Organizational Behavior. 7th Edition, ISBN 978-1260571509, McGraw-Hill Education. Selected articles: Selected key articles will be introduced in class students may be required to search and use additional articles.			

SWBL	**Personal und Organisation**			
Module number	**bwlChangeMan-01a**			
Module title	**Change Management**			
Module level	Deepening Business Administration			
Abbreviation	bwlChangeMan-01a			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Buengeler			
Lecturer	Prof. Dr. C. Buengeler and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Change Management	compulsory	2
	Tutorial	Change Management	compulsory	1
Workload	30 h lecture 15 h exercises 105 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Change Management	Compulsory	Graded	100%
Learning outcome	The students are able to describe and contrast the characteristics of important change theories, models, methods and approaches. They can discuss and evaluate change management practices regarding their effectiveness for different change constellations as well as discuss and contrast the roles and perspectives of different actors and stakeholders in the change process including leaders, managers, and employees as change agents and change recipients. The students have the knowledge to evaluate and connect change management-related scientific literature and apply this to practical questions and cases.			
Content	The aim of this course is to introduce students to the complex and intriguing field of change management theory and practice. Managing and responding to change has emerged as a crucial challenge for organizations and their members in today's global economy. The requirement for organizational members to anticipate and react to change shapes organizational processes, culture, management and leadership styles, and employees' experiences of work, career and identity. During the course, we will examine theories and evidence regarding a variety of themes, including change management practices, resistance to change, and the role of upper and middle managers in the change process. The course will combine a focus on theories of change management, practical insights into change management ideas, techniques and practices as well as challenges through class discussions, case studies, and exercises. Topics include for instance: • Change Models and Theories • Resistance to Change & Change Readiness • Effective Change Management PracticesThe Role of Organizational Culture • The Role of HR • The Role of Upper and Middle Management • The Role of Leadership • The Role of the Individual • Non-Prototypical Leaders			
Media	Blackboard, lecture notes			
Literature	Selected key articles will be introduced in class; students may be required to search and use additional articles.			

SWBL	**Personal und Organisation**			
Module number	**BWL- FSem1OrgPers**			
Module title	**Applied Research in Organizational Behavior A**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSem1OrgPers			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Buengeler			
Lecturer	Prof. Dr. C. Buengeler and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Applied Research in Organizational Behavior A	compulsory	2
Workload	20 h seminar (10 hours per SWS) 130 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	None			

Course related work	None			
Examination(s)	Report with presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Report	Compulsory	Graded	60%
	Presentation	Compulsory	Graded	40%
Learning outcome	The students are able to describe and discuss new themes in leadership research and practice. They describe and discuss the theoretical underpinnings and empirical findings related to these new themes. The students can describe the consequences of these phenomena based on the literature and your own experience and can apply this knowledge to practical questions.			
Content	• The bright side of leadership: Ethical and servant leadership • The dark side of leadership: Leader narcissism, Machiavellianism and psychopathy • Non-prototypical leadership • Cross-cultural leadership and leading diverse teams • Differentiated leadership in team contexts			
Media	Blackboard, lecture notes			
Literature	• Depending on topic			

SWBL	**Corporate Accounting & Business Taxation**			
Module number	**BWL-SteuRefo**			
Module title	**Steuern und Rechtsformen**			
Module level	Deepening Business Administration			
Abbreviation	BWL-SteuRefo			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. J. Heckemeyer			
Lecturer	Prof. Dr. J. Heckemeyer and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Steuern und Rechtsformen	compulsory	2
	Exercises	Steuern und Rechtsformen	compulsory	1
Workload	20 h lecture (10 hours per SWS) 10 h exercises (10 hours per SWS) 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Steuern und Rechtsformen	Compulsory	Graded	100%
Learning outcome	Die Studierenden kennen die Grundlagen der laufenden und aperiodischen Besteuerung deutscher Unternehmen in Abhängigkeit von der Rechtsform. Sie können die Steuerbelastung verschiedener Rechtsformen berechnen. Die Studierenden können dieses Wissen anwenden, um die Determinanten der Steuerbelastung von Unternehmen herauszuarbeiten, so dass Aussagen zur steueroptimalen Rechtsformwahl möglich sind.			
Content	Der Kurs „Steuern und Rechtsformen“ stellt die steuerliche Behandlung deutscher Unternehmen in Abhängigkeit von ihrer Rechtsform dar. Dabei werden sowohl die laufende Geschäftstätigkeit als auch einzelne Tatbestände im Rahmen der aperiodischen Besteuerung betrachtet. Die durch die Veranstaltung vermittelten Inhalte werden im Rahmen verschiedener Fallstudien, welche in den Veranstaltungsablauf und in die vorlesungsbegleitende Übung integriert sind, vertieft. Zentral ist dabei die konkrete Berechnung der Steuerbelastung der verschiedenen Unternehmensrechtsformen sowie Vergleich und Analyse der rechtsformabhängigen Belastungsdifferenzen.			
Media	Blackboard, lecture notes			
Literature	• Jacobs, O.H., Unternehmensbesteuerung und Rechtsform, 5. Aufl., München 2015			

SWBL	**Corporate Accounting & Business Taxation**			
Module number	**BWL-IntUntbest**			
Module title	**Grundlagen der Internationalen Unternehmensbesteuerung**			
Module level	Deepening Business Administration			
Abbreviation	BWL-IntUntbest			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. J. Heckemeyer			
Lecturer	Prof. Dr. J. Heckemeyer and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Grundlagen der Internationalen Unternehmensbesteuerung	compulsory	2
	Exercises	Grundlagen der Internationalen Unternehmensbesteuerung	compulsory	1
Workload	20 h lecture (10 hours per SWS) 10 h exercises (10 hours per SWS) 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			

Prerequisites according to examination order	None			
Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Grundlagen der Internationalen Unternehmens-besteuerung	Compulsory	Graded	100%
Learning outcome	Die Studierenden erwerben Grundlagenwissen über die internationale Unternehmensbesteuerung im Allgemeinen und darüber hinaus Wissen zum deutschen internationalen Steuerrecht. Sie können den Einfluss der Besteuerung auf grenzüberschreitende unternehmerische Entscheidungen beurteilen und die Steuerbelastung von grenzüberschreitenden Unternehmensaktivitäten ermitteln.			
Content	Die Veranstaltung „Grundlagen der internationalen Unternehmensbesteuerung“ behandelt die Grundlagen der internationalen Unternehmensbesteuerung aus der Sicht Deutschlands als Investitionsstandort (Inbound-Investitionen) oder als Sitzstaat des Investors (Outbound-Investitionen). Neben den Grundbegriffen und Grundtatbeständen der internationalen Besteuerung (Doppel- und Minderbesteuerung, DBA, EU-Recht) werden die Besteuerung ausländischer Unternehmen mit Inlandsaktivitäten (Inbound-Investitionen) und die Besteuerung deutscher Unternehmen mit Auslandsaktivitäten (Outbound-Investitionen) betrachtet. Die durch die Veranstaltung vermittelten Inhalte werden im Rahmen von Fallstudien, welche insbesondere in die vorlesungsbegleitende Übung integriert sind, vertieft.			
Media	Blackboard, lecture notes			
Literature	• Jacobs, O.H./Endres, D./Spengel, C. (Hrsg.), Internationale Unternehmensbesteuerung, 8. Aufl., München 2016			

SWBL	**Corporate Accounting & Business Taxation**			
Module number	**BWL-SteuPla**			
Module title	**Steuerplanung und Steuerwirkung**			
Module level	Deepening Business Administration			
Abbreviation	BWL-SteuPla			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. J. Heckemeyer			
Lecturer	Prof. Dr. J. Heckemeyer and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Steuerplanung und Steuerwirkung	compulsory	2
	Exercises	Steuerplanung und Steuerwirkung	compulsory	1
Workload	20 h lecture (10 hours per SWS) 10 h exercises (10 hours per SWS) 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Steuerplanung und Steuerwirkung	Compulsory	Graded	100%
Learning outcome	Die Studierenden kennen den Einfluss des Steuerrechts auf ökonomische Entscheidungen. Besonderes Gewicht liegt auf der Analyse steuerlicher Wirkungen bei einzelnen bedeutsamen Sachverhalten, wie Finanzierungen, Rechtsform, Unternehmenskäufen und Auslandsinvestitionen. Die Studierenden berechnen die tarifliche und effektive Steuerbelastung von Handlungsalternativen und wissen, unter welchen Bedingungen Steuern neutral bzw. entscheidungswirksam sind.			
Content	Inhaltlich befasst sich die Veranstaltung mit dem Einfluss der Steuern auf Kapitalwert und Rendite, der Neutralität der Besteuerung, Entscheidungen über Rechtsform und Finanzierung, Unternehmenskauf und Unternehmensumstrukturierung, Entscheidungen über transnationale Investitionen.			
Media	Blackboard, lecture notes			
Literature	• Schreiber, U., Besteuerung der Unternehmen: Eine Einführung in Steuerrecht und Steuerwirkung, 4. Aufl., Wiesbaden 2017			

SWBL	**Corporate Accounting & Business Taxation**			
Module number	**BWL-FSem1Steu**			
Module title	**Forschungsseminar zur Steuerwirkungsanalyse**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSem1Steu			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. J. Heckemeyer			
Lecturer	Prof. Dr. J. Heckemeyer and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar zur Steuerwirkungsanalyse	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	None			

Course related work	None			
Examination(s)	Seminar work with presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Steuerwirkungs-analyse	Compulsory	Graded	100%
Learning outcome	Die Studierenden sind in der Lage, selbständig eine wissenschaftliche Arbeit auf dem Gebiet der betriebswirtschaftlichen Steuerlehre unter Verwendung einschlägiger quantitativer Methoden zu verfassen, und die Ergebnisse reflektieren und präsentieren können.			
Content	Das Seminar vertieft aktuelle Themen und Problemstellungen der betriebswirtschaftlichen Steuerlehre und führt an die Methodik der empirischen Steuerwirkungsanalyse heran. Betrachtet werden ausgewählte aktuelle, relevante steuerliche Normen bzw. Rechtsentwicklungen im In- oder Ausland, deren Wirkung auf betriebswirtschaftliche Entscheidungen mithilfe einschlägiger empirischer Methoden analysiert wird. Hierzu werden die einschlägige vorhandene Literatur ausgewertet, Hypothesen abgeleitet, geeignete Daten (i.d.R. Sekundärdaten) recherchiert und zusammengestellt, um auf dieser Basis geeignete ökonometrische Verfahren zur Anwendung zu bringen. Im Mittelpunkt stehen eine konsistente betriebswirtschaftliche Fundierung, methodische Vorgehensweise, Ergebnisauswertung und kritische Reflexion.			
Media	Blackboard, lecture notes			
Literature	Will be announced at the beginning of the course.			

SWBL	**Corporate Accounting & Business Taxation**			
Module number	**BWL-FSem2Steu**			
Module title	**Forschungsseminar Unternehmensrechnung und Unternehmensbesteuerung**			
Module level	Deepening Business Administration			
Abbreviation	BWL-FSem2Steu			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. J. Heckemeyer			
Lecturer	Prof. Dr. J. Heckemeyer and staff			
Teaching language	German			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Forschungsseminar Unternehmensrechnung und Unternehmensbesteuerung	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	None			
Examination(s)	Seminar work with presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Forschungsseminar Unternehmensrechnung und Unternehmensbesteuerung	Compulsory	Graded	100%
Learning outcome	Die Studierenden sind in der Lage, selbständig eine wissenschaftliche Arbeit auf dem Gebiet der betriebswirtschaftlichen Steuerlehre, auch auf Basis internationaler Rechtsvergleiche und unter konkreter Anwendung einschlägiger steuerlicher Normen, zu verfassen, und die Ergebnisse präsentieren können.			
Content	Das Seminar vertieft ausgewählte Fragen der betriebs-wirtschaftlichen Steuerlehre. Das Seminar vertieft ausgewählte Fragen der betriebswirtschaftlichen Steuerlehre. Spezifische steuerliche Problemstellungen werden, ggf. auch international rechtsvergleichend, dargestellt und hinsichtlich ihrer steuerplanerischen Relevanz, ggf. auch unter Rückgriff auf konkrete Anwendungsbeispiele, illustriert. Im Mittelpunkt stehen die steuerliche Systematik der ausgewählten Regelungsbereiche und die aus Unternehmenssicht damit verbundenen Implikationen und Risiken.			
Media	Blackboard, lecture notes			
Literature	Will be announced at the beginning of the course.			

SWBL	**Service Analytics**			
Module number	**bwlRevMan-01a**			
Module title	**Revenue Management**			
Module level	Deepening Business Administration			
Abbreviation	bwlRevMan-01a			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Cleophas			
Lecturer	Prof. Dr. C. Cleophas and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Revenue Management	compulsory	2
	Exercises	Revenue Management	compulsory	2
Workload	30 h lecture 30 h exercises 90 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written exam and Research Paper Presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Revenue Management	Compulsory	Graded	100%
Learning outcome	Students have theoretical background knowledge in requirements and conditions of revenue management and pricing. They have experiences in approaches to demand estimation and forecasts. Students know capacity- and price-based revenue optimization models.as well as static and dynamic overbooking models. They also gain hands-on experience in applying these concepts to case scenarios in applying revenue management concepts to new application areas and in extending their understanding of a topic in ongoing development through state-of-the-art research papers			
Content	Revenue Management considers the formulation and solution of tactical and operative pricing problems given methods of operations research. It is based on the sophisticated implementation of quantitative, computer-based planning approaches aiming to maximize revenue. The main instruments are demand forecasting, pricing, capacity-controls, and overbooking. Major application areas are in the service sector, particularly airlines, car rental companies as well as hotels and restaurants. Other application areas include peak-load pricing for energy or telecommunication suppliers as well as mark-down management in the retail industry. The course will cover the following basic topics as well as selected advanced methods: • Revenue management objectives, conditions, and planning process • Concepts of price differentiation • Capacity Controls: For single and multiple resources as well as given independent and dependent demand models • Demand estimation and forecasting • Customer choice modelling • Overbooking • Dynamic Pricing			
Media	Blackboard, lecture notes			
Literature	• K. Talluri und G. van Ryzin, The Theory and Practice of Revenue Management, Kluwer, Amsterdam, 2004 • R. Klein and C. Steinhardt, Revenue Management: Grundlagen und Mathematische Methoden, 2008 • Selected papers as announced during the module			

SWBL	**Service Analytics**			
Module number	**bwlAdvBusAnalytics-01a**			
Module title	**Advanced Business Analytics**			
Module level	Deepening Business Administration			
Abbreviation	bwlAdvBusAnalytics-01a			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Summer Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Cleophas			
Lecturer	Prof. Dr. C. Cleophas and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Advanced Business Analytics	compulsory	2
	Exercises	Advanced Business Analytics	compulsory	2
Workload	30 h lecture 30 h exercises 90 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Advanced Business Analytics	Compulsory	Graded	100%
Learning outcome	Students have theoretical background knowledge in concepts of data management in the business context. They know methods of explorative and intelligent data analysis, basic machine learning concepts and the challenges of "big data". They know discrete event-based and agent-based simulation paradigms and can analyse stochastic simulation results They also gain hands-on experience in applying these concepts, specifically through data analysis and visualization via software tools such as Excel, Python, or R.			
Content	The course focuses on the predictive analysis of processes and systems. To this end, participants are introduced to methods of explorative and intelligent data analysis, concentrating particularly on machine learning and data mining, as well as discrete event-based and agent-based simulation paradigms. While predictive data analysis can be used to create forecasts, it can also be employed to parameterize simulation models. As the implementation of such models, simulation systems enable to evaluate the future effects of changes in the system (e.g. triggered by the application of novel planning approaches). The resulting data, in turn, requires intelligent methods of analysis. When insufficient empirical data is available, we consider how simulation can be employed for data farming. The course will consider the following topics: • The role of data in the firm and to support operational, tactical, and strategic decision making • Standard data management concepts, OLAP • Relational versus non-relational data bases • Data "munging" • Datamining: supervised and unsupervised methods • Evaluation of predictive models: Splitting data sets and cross-validation • The interplay of simulation and predictive analytics • Conceptual modelling for simulation models • Validation and calibration of simulation			
Media	Blackboard, lecture notes			
Literature	• Witten, Eibe & Hall: Data Mining: Practical Machine Learning Tools and Techniques (2011)			

	• Janert, Data Analysis with Open Source Tools • VanderPlas: Python Data Science Handbook

SWBL	**Service Analytics**			
Module number	**bwlServOperMan-01a**			
Module title	**Service Operations Management**			
Module level	Deepening Business Administration			
Abbreviation	bwlServOperMan-01a			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Cleophas			
Lecturer	Prof. Dr. C. Cleophas and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Lecture	Service Operations Management	compulsory	2
	Exercises	Service Operations Management	compulsory	2
Workload	30 h lecture 30 h exercises 90 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			

Recommended prerequisites	None			
Course related work	Submission and presentation of exercises			
Examination(s)	Written examination			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Service Operations Management	Compulsory	Graded	100%
Learning outcome	Students gain theoretical background knowledge and are able to understand mathematical models supporting the topics of service operations management as described in the course content. They also gain hands-on experience in implementing these concepts in algorithms in the exercise.			
Content	The service sector plays a significant role in the economy and comes with its own operational challenges. In this course, participants consider the application of methods of predictive analytics and optimisation to this domain. They get to know the challenges of intangible products and customer-centric service design and find out about the variety of industries that rely on services, ranging from repair shops to the health care sector. The course will consider relevant topics of service operations management, such as • New service development • Managing service experiences: Analyzing processes • Service quality management and sentiment analysis • Predictive service analytics • Location and district problems • Resource allocation and workforce scheduling for services • Workforce planning • Waiting time management and customer scheduling • Yield and inventory management • Service Operations Management Case Studies			
Media	Blackboard, lecture notes			
Literature	• Daskin, Service Science (2010) • Metters et al., Successful Service Operations Management (2006)			

SWBL	**Service Analytics**			
Module number	**bwlResSemSerAnalytics-01a**			
Module title	**Research Seminar: Service Analytics**			
Module level	Deepening Business Administration			
Abbreviation	bwlResSemSerAnalytics-01a			
Subtitle (if applicable)				
Duration	1 Semester			
Repetition in academic year	Winter Term			
Responsible faculty	Faculty of Business, Economics and Social Sciences			
Responsible institute	Institute of Business			
Responsible staff member	Prof. Dr. C. Cleophas			
Lecturer	Prof. Dr. C. Cleophas and staff			
Teaching language	English			
Assignment to the curriculum	Compulsory Elective subject in business administration			
Usability of the module	1-subject study course M.Sc. Materials Science and Business Administration			
Evaluation	Graded			
Module courses	*Course Type*	*Course Name*	*Compulsory/ Compulsory elective*	*SWS*
	Seminar	Research Seminar: Service Analytics	compulsory	2
Workload	30 h seminar 120 h self-organized studies 150 h total workload			
Credits	5 ECTS			
Prerequisites according to examination order	None			
Recommended prerequisites	None			

Course related work	None			
Examination(s)	Report and Presentation			
	Title	*Compulsory / Compulsory elective*	*Graded / Ungraded*	*Weighting*
	Service Analytics	Compulsory	Graded	100%
Learning outcome	The students are able to explore independently a new research domain based on a thorough literature research in service science. They work on a challenging research question in the field of service sciences through individual work and teamwork. The term paper should be based on scientific and professional standards and the findings should be presented in a clear and concise manner.			
Content	The research seminar Service Analytics considers current research topics from the areas of service science, service operations management, business analytics and revenue management. Students are offered selected research papers in the English language and/or specific research questions and data sets. Participants examine their own topic independently based on scientific standards. In individual or group projects, they produce a written report and a professional presentation to communicate their approach and findings. The active participation in discussion rounds and other participants' presentations is part of the expected work. The course will consider selected topics of current interest from the areas service science, service operations management, business analytics and revenue management. Exemplary application domains include health care, tourism, and transport.			
Media	Blackboard, lecture notes			
Literature	An initial reading list is individually assigned per module and student. Further literature should be discovered as part of the literature research.			