Julius-Maximilians-
UNIVERSITÄT
WÜRZBURG

Module Catalogue

for the Subject

Technology of Functional Materials

as a Master's with 1 major

with the degree "Master of Science"

(120 ECTS credits)

Examination regulations version: 2009
Responsible: Faculty of Chemistry and Pharmacy

Contents

The subject is divided into

Content and Objectives of the Programme

The »Technology of Functional Material« course programme (120 ECTS credits) with the Master of Science qualification prepares students for work of a scientific nature in the interdisciplinary area of materials science with a focus on functional materials. Students deepen their knowledge of specific topics and the methodical basics of the scientific work from their Bachelor studies. This course also prepares students for PhD-studies (Dr.rer.nat or Dr.-Ing.). The interdisciplinary character of this degree programme is reflected in co-operations with the Fachhochschule Würzburg-Schweinfurt, the Fraunhofer Institut für Silicatforschung, the Süddeutsches Kunststoffzentrum Würzburg , and the Bavarian Centre for Applied Energy Research (ZAE Bayern). These bring students into contact with the many topics of modern functional materials in the areas of chemistry, physics, materials science, and bio materials. The compulsory topics (35 ECTS credits) consist of lectures and practical training courses from the areas of Physics and Chemistry on mechanical/thermal and optical/electronic material properties, as well as nano-scale and sensor/actuator materials. These topics include a colloquium for the master thesis (5 ECTS credits) as well as a project assignment (10 ECTS credits) which can - as is the case for the master thesis - be undertaken at the universities and at the named research institutes participating in the course program or in industrial companies. The optional topics are divided into general topics (30 ECTS credits), where students may choose from Chemistry, Physics, Computer Science and Mathematics, and specific topics (30 ECTS credits). Here, students may choose between the Bio Materials and Technical Functional Materials subject areas. In their master thesis (25 ECTS credits) students show that they are able to deal predominantly independently with a thematically and temporally restricted experimental or theoretical topic from (engineering) sciences on the basis of their acquired methods and scientific skills. The results of the master thesis are presented and graded in a compulsory colloquium. The internationally comparable Master Degree qualifies students for scientifically oriented work in research and development in materials science with a focus on functional materials, as well as for attending a PhD study program.

Abbreviations used

Course types: **E** = field trip, **K** = colloquium, **O** = conversatorium, **P** = placement/lab course, **R** = project, **S** = seminar, **T** = tutorial, **Ü** = exercise, **V** = lecture

Term: **SS** = summer semester, **WS** = winter semester

Methods of grading: **NUM** = numerical grade, **B/NB** = (not) successfully completed

Regulations: **(L)ASPO** = general academic and examination regulations (for teaching-degree programmes), **FSB** = subject-specific provisions, **SFB** = list of modules

Other: **A** = thesis, **LV** = course(s), **PL** = assessment(s), **TN** = participants, **VL** = prerequisite(s)

Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

In accordance with

the general regulations governing the degree subject described in this module catalogue:

ASPO2007

associated official publications (FSB (subject-specific provisions)/SFB (list of modules)):

21-Jul-2009 (2009-43) except for mandatory electives added in Fast Track procedure at a later time

05-Oct-2009 (2009-84)

This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.

Compulsory Courses

(35 ECTS credits)

Module title			Abbreviation
Mechanical and Thermal Material Properties			11-E5T-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Admission prerequisite to assessment: successful completion of approx. 50% of exercises. Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.	

Contents

Physical laws of solids: Bonding and structure, lattice dynamics, thermal and mechanical properties.

Intended learning outcomes

The students have knowledge of mechanical/thermal material characteristics.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate) or c) project report (approx. 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Opto-electronic Material Properties			11-MOE-092-m01

Module coordinator	Module offered by
Managing Director of the Institute of Applied Physics	Faculty of Physics and Astronomy

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	Admission prerequisite to assessment: successful completion of approx. 50% of exercises. Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Contents

Physical principles of optoelectronic material properties and applications.

Intended learning outcomes

The students know the principles of optoelectronic material characteristics.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)

Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Nanoscale Materials			08-PCM4-092-m01
Module coordinator		**Module offered by**	
lecturer of the seminar "Nanoskalige Materialien"		Institute of Physical and Theoretical Chemistry	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

This module discusses advanced topics in nanoscale materials. It focuses on the structure, properties, fabrication, modern characterisation methods and application areas of nanoscale materials.

Intended learning outcomes

Students are able to characterise nanoscale materials. They are able to name analytical methods and application areas of nanoscale materials.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) or b) oral examination (approx. 20 minutes) or c) talk (approx. 40 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Technology of Sensor and Actor Materials including Smart Fluids			08-SAM-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Fabrication, effects and applications of sensory and actuatory materials such as piezoelectrics, shape memory materials and magnetostrictive materials. Electrorheological and magnetorheological fluids, magnetofluids.

Intended learning outcomes

Students have developed fundamental knowledge in the area of sensory and actuatory materials.

Courses (type, number of weekly contact hours, language — if other than German)

V + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)

Module title			Abbreviation
Research project			08-PR-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
10	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

This module gives students the opportunity to work independently on experiments on a topic in functional materials.

Intended learning outcomes

Students are able to independently work on a defined topic in functional materials and to present their findings in written form.

Courses (type, number of weekly contact hours, language — if other than German)

R (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

report (approx. 10 to 15 pages)
Language of assessment: German or English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Master Thesis' Colloquium			08-MKoll-TF-092-m01
Module coordinator		**Module offered by**	
Dean of Studies Funktionswerkstoffe (Functional Materials)		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Master's thesis defence.

Intended learning outcomes

Students are able to orally defend their Master's thesis.

Courses (type, number of weekly contact hours, language — if other than German)

K (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

final colloquium (approx. 90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Compulsory Electives

(60 ECTS credits)

General Compulsory Electives

(30 ECTS credits)

Module title			Abbreviation
Laboratory and Measurement Technology			11-A3-072-m01

Module coordinator	Module offered by
Managing Director of the Institute of Applied Physics	Faculty of Physics and Astronomy

ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	Admission prerequisite to assessment: successful completion of approx. 50% of exercises. Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Contents

Introduction to electronic and optical measuring methods of physical metrology, vacuum technology and cryogenics, cryogenics, light sources, spectroscopic methods and measured value acquisition.

Intended learning outcomes

The students have acquired the following transferable skills: Electronic and optical measuring methods in physical metrology, cryogenics and vacuum technology, cryogenics, light sources, spectroscopic methods and measured value acquisition.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 120 minutes)

Allocation of places

Only as part of pool of general key skills (ASQ): 15 places. Places will be allocated by lot.

Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2007)
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2009)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Physics (2008)
Bachelor' degree (1 major) Nanostructure Technology (2010)

Bachelor' degree (1 major) Nanostructure Technology (2012)
Bachelor' degree (1 major) Nanostructure Technology (2008)
Bachelor' degree (1 major) Nanostructure Technology (2007)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Functional Materials (2012)
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2008)
Bachelor's degree (1 major, 1 minor) Physics (Minor, 2010)

Module title			Abbreviation
Nanomatrix insulation systems and photovoltaics			11-NM-WP-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Principles and specific knowledge of engineering work in the application fields of energy engineering, electronics, photonics and biophysics as well as in the technology-oriented materials sciences, technologies of nanostructuring, components and system development, especially in the field of thermal insulation systems and photovoltaics.

Intended learning outcomes

The students have advanced knowledge of one or more application or technology areas of engineering work, especially in the field of thermal insulation systems and photovoltaics.

Courses (type, number of weekly contact hours, language — if other than German)

V + R (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Nanostructure Technology (2008)
Bachelor' degree (1 major) Nanostructure Technology (2007)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Nanomatrix semiconductor materials			11-NM-HM-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Principles and specific knowledge of engineering work in the application fields of energy engineering, electronics, photonics and biophysics as well as in the technology-oriented materials sciences, technologies of nanostructuring, components and system development, especially in the field of semiconductor materials.

Intended learning outcomes

The students have advanced knowledge of one or more application or technology areas of engineering work, especially in the field of semiconductor materials.

Courses (type, number of weekly contact hours, language — if other than German)

V + R (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Nanostructure Technology (2008)
Bachelor' degree (1 major) Nanostructure Technology (2007)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Nanomatrix Semiconductor Processing			11-NM-HP-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Principles and specific knowledge of engineering work in the application fields of energy engineering, electronics, photonics and biophysics as well as in the technology-oriented materials sciences, technologies of nanostructuring, components and system development, especially in the field of semiconductor processes.

Intended learning outcomes

The students have advanced knowledge of one or more application or technology areas of engineering work, especially in the field of semiconductor processes.

Courses (type, number of weekly contact hours, language — if other than German)

V + R (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Nanostructure Technology (2008)
Bachelor' degree (1 major) Nanostructure Technology (2007)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Nanomatrix Biophysical Analyzing Systems and Processes			11-NM-BV-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Principles and specific knowledge of engineering work in the application fields of energy engineering, electronics, photonics and biophysics as well as in the technology-oriented materials sciences, technologies of nanostructuring, components and system development, especially in the field of biophysical analysis systems and procedures.

Intended learning outcomes

The students have advanced knowledge of one or more application or technology areas of engineering work, especially in the field of biophysical analysis systems and techniques.

Courses (type, number of weekly contact hours, language — if other than German)

V + R (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Nanostructure Technology (2008)
Bachelor' degree (1 major) Nanostructure Technology (2007)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Ordinary Differential Equations			10-M-ODE-082-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.	

Contents

Existence and uniqueness theorem; continuous dependence of solutions on initial values; systems of linear differential equations; matrix exponential series; linear differential equations of higher order.

Intended learning outcomes

The student is acquainted with the fundamental concepts and methods of the theory of ordinary differential equations. He/she is able to apply these methods to practical problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)
Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Computer Science (2007)
Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Physics (2008)
Bachelor' degree (1 major) Technology of Functional Materials (2009)
Bachelor' degree (1 major) Technology of Functional Materials (2010)

Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Aerospace Computer Science (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2011)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Functional Materials (2012)
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)
Bachelor' degree (1 major) Technology of Functional Materials (2006)

Module title			Abbreviation
Chemical Nanotechnology - Characterization Techniques and Applications			08-FS5-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

The module provides an application-oriented introduction to the characterisation methods of nanochemistry and includes practical exercises. It also discusses thermoanalysis, rheological processes and dynamic light scattering. The lecture also offers insights into the applications of nanomaterials in the industrial and technological sectors.

Intended learning outcomes

Students have developed an advanced knowledge of sol-gel chemistry and biomineralisation.

Courses (type, number of weekly contact hours, language — if other than German)

This module comprises 2 module components. Information on courses will be listed separately for each module component.

- 08-FS5-1-092: V (no information on SWS (weekly contact hours) and course language available)
- 08-FS5-2-092: V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

Assessment in module component 08-FS5-1-092: Sol-Gel Chemistry 2: Thin Film Processing

- 2 ECTS, Method of grading: numerical grade
- oral examination (approx. 15 minutes)

Assessment in module component 08-FS5-2-092: Application Oriented Charakterization of Colloidal (Molecular) Systems

- 3 ECTS, Method of grading: numerical grade
- oral examination (approx. 20 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Coating Technology based on Vapour Deposition			08-FS6-092-m01
Module coordinator		**Module offered by**	
Dean of Studies Funktionswerkstoffe (Functional Materials)		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Theoretical principles: CVD and PVD installations, gas phase processes and layer materials. Layer production and characterisation, optimisation of the coating process. Insights into layer production on an industrial scale.

Intended learning outcomes

Students have developed an advanced knowledge of gas-phase layer deposition processes and have become familiar with modern CVD and PVD coating techniques.

Courses (type, number of weekly contact hours, language — if other than German)

V + P + E (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Applied Spectroscopy 3			08-PS3-092-m01
Module coordinator		**Module offered by**	
lecturer of lecture "Praktische Spektroskopie 3"		Institute of Physical and Theoretical Chemistry	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

This module gives students the opportunity to apply their theoretical knowledge of spectroscopic methods in practice and to interpret readings or graphs. We will record and analyse UV-VIS, fluorescence and vibration spectra and discuss modern mass spectrometry methods.

Intended learning outcomes

Students are able to work with different spectrometers and to interpret the resulting spectra. They are able to conduct error discussions.

Courses (type, number of weekly contact hours, language — if other than German)

V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

1 written examination (approx. 90 minutes) or 2 written examinations (approx. 60 or 90 minutes each) or 3 written examinations (approx. 60 minutes each) or oral examination of one candidate each (approx. 20 minutes) or oral examination in groups (groups of 2, approx. 30 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Chemistry (2010)
Bachelor' degree (1 major) Chemistry (2009)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Organic Chemistry for students of engineering			08-IOC4-092-m01
Module coordinator		**Module offered by**	
lecturer of lecture "Organische Chemie 4"		Institute of Organic Chemistry	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Registration for assessment: Yes, as specified.	

Contents

This module discusses biologically important bonding classes, their reactions and syntheses.

Intended learning outcomes

Students have become familiar with biologically important bonding classes, their reactions and syntheses.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Basic principles of cell biology and tissue regeneration			03-SP1A1-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Orthopaedics and holder of the Chair of Regenerative Medicine		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Cell biology, metabolism, differentiation, cell behaviour, cell/cell interactions, cell adhesion, 2D/3D and surface geometry, mechanobiology (bioreactors with mechanics).

Intended learning outcomes

Students have developed a knowledge of cell biology, metabolism, differentiation, adhesion to surfaces, mechanobiology.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Basics of tissue engineering and quality management			03-SP1A2-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Regenerative Medicine and holder of the Chair of Functional Materials in Medicine and Dentistry		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Tissue engineering of complex constructs: supply, hypoxia, nutrient diffusion, extracellular matrix, supply of nerves and blood vessels. Risk analysis according to ISO 17025: 2005, biological evaluation of medical devices according to DIN EN ISO 10993.

Intended learning outcomes

Students are familiar with the fundamental principles of tissue engineering and quality management.

Courses (type, number of weekly contact hours, language — if other than German)

S + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Materials used for surgical implants			03-SP2A1-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Orthopaedics (Jakob/Ebert)		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Function and application of different medical implants (cardiovascular system, catheter systems, organs of perception, bones, teeth).

Intended learning outcomes

Students have developed a knowledge of the application of implants in different organs and tissues and their compatibility and interaction with the organism.

Courses (type, number of weekly contact hours, language — if other than German)

V + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (60 minutes) and log (approx. 5 pages), weighted 3:1

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Materials for biosensors, tissue engineering and tissue regeneration			03-SP2A2-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Orthopaedics and holder of the Chair of Regenerative Medicine		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Interaction of biosystems with materials, biodegradation versus inert materials, protein adsorption on surfaces as an information broker for sensors, biological materials, structure-function interaction (nano-microstructures).

Intended learning outcomes

Students have developed a knowledge of the interaction of the biosystem with materials.

Courses (type, number of weekly contact hours, language — if other than German)

S + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (60 minutes) and log (approx. 5 pages), weighted 3:1

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Carrier materials and devices for therapeutic compounds			03-SP3A1-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Functional Materials in Medicine and Dentistry		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Integration and binding of active agents in particles, functionalisation of particles for (intracellular) transport processes, targeting and release of the active agents.

Intended learning outcomes

Students have developed a knowledge of the integration and binding of active agents in particles and of the functionalisation of particles for (intracellular) transport processes, targeting and release of active agents.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Microsystems for biological and medical applications			03-SP3A2-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Functional Materials in Medicine and Dentistry and holder of the Chair of Regenerative Medicine		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Implantable drug delivery systems, lab-on-a-chip systems for bioanalysis, bioreactor technology, lab course: nanoparticles for regenerative medicine and protein biochemistry.

Intended learning outcomes

Students have developed a knowledge of implantable drug delivery systems and lab-on-a-chip systems for bioanalysis, bioreactor technology, nanoparticles for regenerative medicine and protein biochemistry.

Courses (type, number of weekly contact hours, language — if other than German)

S + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (60 minutes) and log (approx. 5 pages), weighted 3:1

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Organic Semiconductor			11-OHL-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Admission prerequisite to assessment: successful completion of approx. 50% of exercises. Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.	

Contents

Physical principles of organic semiconductors, molecular and polymer electronics and sensor technology, applications.

Intended learning outcomes

The students have advanced knowledge of organic semiconductors.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Technology of Functional Materials (2010)

Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Polymeric Materials 1: Technology of Modifying Polymers			08-PW1-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Polymer synthesis methods; the structure of polymers and polymer compounds; properties of polymers; technologies for the manufacturing of polymer compounds and components, procedures for the characterisation of polymer compounds and components.

Intended learning outcomes

Students have developed a knowledge of the special properties of polymers and polymer compounds (e.g. time and temperature-dependent viscoelastic behaviour). They have become familiar with the characteristics of important production technologies (polymer synthesis methods, compounding technologies, processing methods such as injection moulding) and understand the different ways of influencing the properties of materials and manufactured products. They have become familiar with ways to calculate complex flow conditions in polymer processing machines and tools.

Courses (type, number of weekly contact hours, language — if other than German)

V + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Polymeric Materials 2: Technology of Modifying Fillers for Polymers			08-PW2-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Principles of and technologies for the functionalisation of filler materials in order to modify polymers, interactions between filler materials and polymers, determination of the special properties of functionalised polymers (e.g. electrical behaviour, bactericidal behaviour) and influence of functionalisation on other properties (e.g. rheology, mechanical behaviour, colour, surface).

Intended learning outcomes

Students have become familiar with technologies for the functionalisation of filler materials. They have developed an awareness of the possibilities and problems associated with the modification of polymers as well as the interactions between filler materials and polymers. They know how to determine the special properties of functionalised polymers (e.g. electrical behaviour, bactericidal behaviour) and understand how other properties are influenced by functionalisation (e.g. rheology, mechanical behaviour, colour, surface).

Courses (type, number of weekly contact hours, language — if other than German)

V + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Electrochemical Energy Storage and Conversion			08-EEW-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Chemistry and application of: battery systems (aqueous and non-aqueous systems such as lead, nickel cadmium and nickel metal hydride, sodium sulphur, sodium nickel chloride, lithium ion accumulators), electrochemical double layer capacitors, redox-flow batteries, fuel cell systems (AFC, PEMFC, DMFC, PAFC, SOFC), solar cells (Si, CIS, CIGS, GaAs, organic and dye solar cell), thermoelectric devices.

Intended learning outcomes

Students have developed a knowledge of electrochemical energy storage and conversion and are able to apply that knowledge to research problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + P + E (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes) and lab report (approx. 5 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Structure and Properties of Modern Materials: Experiments and Simulations			08-MW-092-m01
Module coordinator			**Module offered by**
holder of the Chair of Chemical Technology of Material Synthesis			Chair of Chemical Technology of Material Synthesis
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Material properties of metals and ceramics: correlation of structure/property relations through experiments and simulations.

Intended learning outcomes

Students gain an insight into the properties of modern materials: aerospace aluminium alloys and high-performance ceramics. They are introduced to measuring methods and calculation methods using numerical simulation. A special focus is on the relation between the micro/nanoscopic structure of materials and the resulting properties.

Courses (type, number of weekly contact hours, language — if other than German)

V + S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

talk (approx. 45 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Organic functional materials			08-OF-092-m01

Module coordinator	Module offered by
lecturer of the seminar "Organische Funktionsmaterialien"	Institute of Organic Chemistry

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	--

Contents

The module deals with specific topics in organic functional materials. The focus is on fundamental (photo)physical effects in organic molecular and polymeric semiconductors as well as their application in (opto)electronic components such as field effect transistors, organic light-emitting diodes, or organic solar cells as well as in nonlinear optics.

Intended learning outcomes

The students are able to explain fundamental (photo)physical processes in organic semiconductors. He/She can explain the synthesis of these semiconductor materials as well as their application in (opto)electronic components such as field effect transistors, organic light-emitting diodes or in organic photovoltaics as well as in nonlinear optics.

Courses (type, number of weekly contact hours, language — if other than German)

V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Data bases 2			10-I-DB2-092-m01
Module coordinator		**Module offered by**	
Dean of Studies Informatik (Computer Science)		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Data warehouses and data mining; XML databases; web databases;introduction to Datalog.

Intended learning outcomes

The students possess an advanced knowledge of databases, XML and data mining.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (50 minutes) or oral examination (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
E-Learning			10-I-EL-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Computer Science VI		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

History and foundations, planning and analysis, formats of multimedia learning, content structuring, multimedia design, interaction design, motivation design, quality assurance, technical implementation, learning platforms, case-based training systems, eLearning standards.

Intended learning outcomes

The students possess a theoretical and practical knowledge about eLearning and are able to assess possible applications.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (50 minutes) or oral examination (one candidate each: 15 minutes, groups of 2: 20 minutes, groups of 3: 25 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Information Retrieval			10-I-IR-092-m01
Module coordinator		**Module offered by**	
Dean of Studies Informatik (Computer Science)		Institute of Computer Science	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

IR models (e. g. Boolean and vector space model, evaluation), processing of text (tokenising, text properties), data structures (e. g. inverted index), query elements (e. g. query operations, relevance feedback, query languages and paradigms, structured queries), search engine (e. g. architecture, crawling, interfaces, link analysis), methods to support IR (e. g. recommendation systems, text clustering and classification, information extraction).

Intended learning outcomes

The students possess theoretical and practical knowledge in the area of information retrieval and have acquired the technical know-how to create a search engine.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 50 minutes) or b) oral examination (one candidate each: approx. 15 minutes, groups of 2: approx. 20 minutes, groups of 3: approx. 25 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title	Abbreviation
Materials for high voltage insulation and high voltage systems	99-HIS-092-m01

Module coordinator	Module offered by
Dean of the Faculty of Electrical Engineering at the University of Applied Sciences Würzburg-Schweinfurt	University of Applied Sciences Würzburg- Schweinfurt (FHWS)

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	unknown	--

Contents

No information on contents available.

Intended learning outcomes

No information on intended learning outcomes available.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Modelling and simulation for technology systems			99-MSTS-092-m01
Module coordinator		**Module offered by**	
Dean of the Faculty of Mechanical Engineering at the University of Applied Sciences Würzburg-Schweinfurt		University of Applied Sciences Würzburg- Schweinfurt (FHWS)	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	unknown	--	

Contents

No information on contents available.

Intended learning outcomes

No information on intended learning outcomes available.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 minutes) or modelling assignment in the form of a project (expenditure of time for modelling assignment to be specified at the beginning of the course)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Introduction to Functional Analysis			10-M-FAN-072-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.	

Contents

Banach spaces and Hilbert spaces, bounded operators, principles of functional analysis.

Intended learning outcomes

The student knows the fundamental concepts and methods of functional analysis as well as the pertinent proof methods, is able to apply methods from linear algebra and analysis to functional analysis, and realises the broad applicability of the theory to other branches of mathematics.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)
Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 73 (1) 1. Mathematik Analysis

Module appears in

Bachelor' degree (1 major) Mathematics (2008)
Bachelor' degree (1 major) Mathematics (2007)
Bachelor' degree (1 major) Technology of Functional Materials (2009)
Bachelor' degree (1 major) Technology of Functional Materials (2010)
Bachelor' degree (1 major) Economathematics (2009)

Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Computational Mathematics (2009)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Functional Materials (2012)
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)
First state examination for the teaching degree Gymnasium Mathematics (2009)
Bachelor' degree (1 major) Technology of Functional Materials (2006)

Module title			Abbreviation
Computational Mathematics, advanced			10-M-COMg-082-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
4	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Admission prerequisite to assessment: regular attendance of exercises (attendance monitored, a maximum of one incident of unexcused absence).	

Contents

Introduction to modern mathematical software for symbolic computation (e. g. Mathematica or Maple) and numerical computation (e. g. Matlab) to supplement the basic modules in analysis and linear algebra (10-M-ANA, 10-M-ANL and 10-M-LNA). Computer-based solution of problems in linear algebra, geometry, analysis, in particular differential and integral calculus; visualisation of functions.

Intended learning outcomes

The student learns the use of advanced modern mathematical software packages, and is able to assess their fields of application to solve mathematical problems.

Courses (type, number of weekly contact hours, language — if other than German)

Ü + V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project in the form of programming exercises (type and expenditure of time to be specified by the lecturer at the beginning of the course)
Assessment offered: once a year, summer semester
Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 73 (1) 5. Mathematik Angewandte Mathematik

Module appears in

Bachelor' degree (1 major) Mathematics (2008)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Computational Mathematics (2009)
Master's degree (1 major) Technology of Functional Materials (2009)
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)
First state examination for the teaching degree Gymnasium Mathematics (2009)

Module title			Abbreviation
Numerical Mathematics 1			10-M-NM1-082-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
8	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.	

Contents

Solution of systems of linear equations and curve fitting problems, nonlinear equations and systems of equations, interpolation with polynomials, splines and trigonometric functions, numerical integration.

Intended learning outcomes

The student is acquainted with the fundamental concepts and methods in numerical mathematics, applies them to practical problems and knows about their typical fields of application.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)
Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 73 (1) 5. Mathematik Angewandte Mathematik

Module appears in

Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Mathematics (2008)
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2009)
Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Physics (2008)
Bachelor' degree (1 major) Technology of Functional Materials (2009)
Bachelor' degree (1 major) Technology of Functional Materials (2010)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Computational Mathematics (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2011)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Functional Materials (2012)
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)
First state examination for the teaching degree Gymnasium Mathematics (2009)

Module title			Abbreviation
Numerical Mathematics 2			10-M-NM2-082-m01

Module coordinator	Module offered by
Dean of Studies Mathematik (Mathematics)	Institute of Mathematics

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.

Contents

Solution methods and applications for eigenvalue problems, linear programming, initial value problems for ordinary differential equations, boundary value problems.

Intended learning outcomes

The student is able to draw a distinction between the different concepts of numerical mathematics and knows about their advantages and limitations concerning the possibilities of application in different fields of natural and engineering sciences and economics.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 minutes); if announced by the lecturer, the written examination can be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups (groups of 2, approx. 30 minutes)
Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 73 (1) 5. Mathematik Angewandte Mathematik

Module appears in

Bachelor' degree (1 major) Mathematics (2008)
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2009)
Bachelor' degree (1 major) Physics (2012)

Bachelor' degree (1 major) Physics (2008)
Bachelor' degree (1 major) Technology of Functional Materials (2009)
Bachelor' degree (1 major) Technology of Functional Materials (2010)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Computational Mathematics (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2009)
Bachelor' degree (1 major) Aerospace Computer Science (2011)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) Functional Materials (2012)
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)
First state examination for the teaching degree Gymnasium Mathematics (2009)

Module title			Abbreviation
Programming course for students of Mathematics and other subjects			10-M-PRG-082-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Admission prerequisite to assessment: regular attendance (attendance monitored, a maximum of one incident of unexcused absence).	

Contents

Basics of a modern programming language (e. g. C or Fortran) taking into account the particular needs in mathematics.

Intended learning outcomes

The student is able to work independently on small programming exercises and standard programming problems in mathematics.

Courses (type, number of weekly contact hours, language — if other than German)

P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project in the form of programming exercises (as specified at the beginning of the course)
Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 73 (1) 5. Mathematik Angewandte Mathematik

Module appears in

Bachelor' degree (1 major) Mathematics (2008)
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2009)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Physics (2008)
Bachelor' degree (1 major) Technology of Functional Materials (2009)
Bachelor' degree (1 major) Technology of Functional Materials (2010)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Economathematics (2009)
Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Computational Mathematics (2009)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Technology of Functional Materials (2010)

Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Functional Materials (2012)
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)
First state examination for the teaching degree Gymnasium Mathematics (2009)

Module title			Abbreviation
Computeroriented Mathematics			10-M-COM-082-m01
Module coordinator		**Module offered by**	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
3	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	Admission prerequisite to assessment: regular attendance of exercises (attendance monitored, a maximum of one incident of unexcused absence).	

Contents

Introduction to modern mathematical software for symbolic computation (e. g. Mathematica or Maple) and numerical computation (e. g. Matlab) to supplement the basic modules in analysis and linear algebra ((10-M-ANA or 10-M-ANL) and 10-M-LNA). Computer-based solution of problems in linear algebra, geometry, analysis, in particular differential and integral calculus; visualisation of functions.

Intended learning outcomes

The student learns the use of advanced modern mathematical software packages, and is able to assess their fields of application to solve mathematical problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project in the form of programming exercises (as specified at the beginning of the course)
Assessment offered: once a year, summer semester
Language of assessment: German, English if agreed upon with the examiner

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 73 (1) 5. Mathematik Angewandte Mathematik

Module appears in

Bachelor' degree (1 major) Computer Science (2010)
Bachelor' degree (1 major) Mathematics (2008)
Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2009)
Bachelor' degree (1 major) Physics (2012)
Bachelor' degree (1 major) Physics (2008)
Bachelor' degree (1 major) Technology of Functional Materials (2009)
Bachelor' degree (1 major) Technology of Functional Materials (2010)
Bachelor' degree (1 major) Nanostructure Technology (2010)
Bachelor' degree (1 major) Economathematics (2009)

Bachelor' degree (1 major) Economathematics (2008)
Bachelor' degree (1 major) Mathematical Physics (2009)
Bachelor' degree (1 major) Computational Mathematics (2009)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Functional Materials (2012)
Bachelor's degree (1 major, 1 minor) Mathematics (Minor, 2008)
First state examination for the teaching degree Gymnasium Mathematics (2009)

Module title			Abbreviation
Physical chemistry of supramolecular assemblies			08-PCM5-102-m01
Module coordinator			**Module offered by**
lecturer of the seminar "Physikalische Chemie Supramolekularer Strukturen"			Institute of Physical and Theoretical Chemistry
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

This module examines the basic interactions between molecules. It discusses the formation and physical-chemical properties of aggregates as well as key applications of supramolecular chemistry.

Intended learning outcomes

Students are able to explain the basic interactions between molecules demonstrating a high degree of expertise in the field. They can describe the formation and physical-chemical properties of aggregates. They can name modern applications of supramolecular chemistry.

Courses (type, number of weekly contact hours, language — if other than German)

S + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes) and/or oral examination of one candidate each (20 minutes) and/or talk (30 minutes)
Language of assessment: German or English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Chemistry (2013)
Master's degree (1 major) Chemistry (2010)
Master's degree (1 major) Mathematics (2012)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Computational Mathematics (2012)
Master's degree (1 major) Functional Materials (2012)

Module title	Abbreviation
Chemically and bio-inspired Nanotechnology for Material Synthesis	08-NT-122-m01

Module coordinator	Module offered by
holder of the Chair of Chemical Technology of Material Synthesis	Chair of Chemical Technology of Material Synthesis

ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	graduate	--

Contents

This module provides an introduction to the synthesis methods of sol-gel chemistry and discusses the methods of analysis used to characterise the generated materials. It also discusses the fundamental principles of biomineralisation and uses examples to introduce students to bio-inspired material synthesis.

Intended learning outcomes

Students have developed an advanced knowledge of sol-gel chemistry and biomineralisation.

Courses (type, number of weekly contact hours, language — if other than German)

This module comprises 2 module components. Information on courses will be listed separately for each module component.

- 08-NT-1-122: V (no information on SWS (weekly contact hours) and course language available)
- 08-NT-2-122: V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

Assessment in module component 08-NT-1-122: Sol-Gel Chemistry 1: Fundamentals

- 2 ECTS, Method of grading: numerical grade
- a) written examination (approx. 45 minutes) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)

Assessment in module component 08-NT-2-122: From Biomineralisation to biologically inspired Materials Synthesis

- 3 ECTS, Method of grading: numerical grade
- a) written examination (approx. 45 minutes) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Nanostructure Technology (2012)

Bachelor' degree (1 major) Functional Materials (2012)
Master's degree (1 major) Chemistry (2013)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Functional Materials (2012)

Focus Area

(30 ECTS credits)

Focus Topic A: Bio-compatible materials

(30 ECTS credits)

Module title			Abbreviation
Basic principles of cell biology and tissue regeneration			03-SP1A1-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Orthopaedics and holder of the Chair of Regenerative Medicine		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Cell biology, metabolism, differentiation, cell behaviour, cell/cell interactions, cell adhesion, 2D/3D and surface geometry, mechanobiology (bioreactors with mechanics).

Intended learning outcomes

Students have developed a knowledge of cell biology, metabolism, differentiation, adhesion to surfaces, mechanobiology.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Basics of tissue engineering and quality management			03-SP1A2-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Regenerative Medicine and holder of the Chair of Functional Materials in Medicine and Dentistry		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Tissue engineering of complex constructs: supply, hypoxia, nutrient diffusion, extracellular matrix, supply of nerves and blood vessels. Risk analysis according to ISO 17025: 2005, biological evaluation of medical devices according to DIN EN ISO 10993.

Intended learning outcomes

Students are familiar with the fundamental principles of tissue engineering and quality management.

Courses (type, number of weekly contact hours, language — if other than German)

S + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Materials used for surgical implants			03-SP2A1-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Orthopaedics (Jakob/Ebert)		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Function and application of different medical implants (cardiovascular system, catheter systems, organs of perception, bones, teeth).

Intended learning outcomes

Students have developed a knowledge of the application of implants in different organs and tissues and their compatibility and interaction with the organism.

Courses (type, number of weekly contact hours, language — if other than German)

V + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (60 minutes) and log (approx. 5 pages), weighted 3:1

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Materials for biosensors, tissue engineering and tissue regeneration			03-SP2A2-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Orthopaedics and holder of the Chair of Regenerative Medicine		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Interaction of biosystems with materials, biodegradation versus inert materials, protein adsorption on surfaces as an information broker for sensors, biological materials, structure-function interaction (nano-microstructures).

Intended learning outcomes

Students have developed a knowledge of the interaction of the biosystem with materials.

Courses (type, number of weekly contact hours, language — if other than German)

S + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (60 minutes) and log (approx. 5 pages), weighted 3:1

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Carrier materials and devices for therapeutic compounds			03-SP3A1-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Functional Materials in Medicine and Dentistry		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Integration and binding of active agents in particles, functionalisation of particles for (intracellular) transport processes, targeting and release of the active agents.

Intended learning outcomes

Students have developed a knowledge of the integration and binding of active agents in particles and of the functionalisation of particles for (intracellular) transport processes, targeting and release of active agents.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Microsystems for biological and medical applications			03-SP3A2-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Functional Materials in Medicine and Dentistry and holder of the Chair of Regenerative Medicine		Faculty of Medicine	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Implantable drug delivery systems, lab-on-a-chip systems for bioanalysis, bioreactor technology, lab course: nanoparticles for regenerative medicine and protein biochemistry.

Intended learning outcomes

Students have developed a knowledge of implantable drug delivery systems and lab-on-a-chip systems for bioanalysis, bioreactor technology, nanoparticles for regenerative medicine and protein biochemistry.

Courses (type, number of weekly contact hours, language — if other than German)

S + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (60 minutes) and log (approx. 5 pages), weighted 3:1

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Focus Topic B: Technical Materials

(30 ECTS credits)

Module title			Abbreviation
Nanomatrix insulation systems and photovoltaics			11-NM-WP-072-m01

Module coordinator	Module offered by
Managing Director of the Institute of Applied Physics	Faculty of Physics and Astronomy

ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Principles and specific knowledge of engineering work in the application fields of energy engineering, electronics, photonics and biophysics as well as in the technology-oriented materials sciences, technologies of nanostructuring, components and system development, especially in the field of thermal insulation systems and photovoltaics.

Intended learning outcomes

The students have advanced knowledge of one or more application or technology areas of engineering work, especially in the field of thermal insulation systems and photovoltaics.

Courses (type, number of weekly contact hours, language — if other than German)

V + R (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Nanostructure Technology (2008)
Bachelor' degree (1 major) Nanostructure Technology (2007)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Nanomatrix semiconductor materials			11-NM-HM-072-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Principles and specific knowledge of engineering work in the application fields of energy engineering, electronics, photonics and biophysics as well as in the technology-oriented materials sciences, technologies of nanostructuring, components and system development, especially in the field of semiconductor materials.

Intended learning outcomes

The students have advanced knowledge of one or more application or technology areas of engineering work, especially in the field of semiconductor materials.

Courses (type, number of weekly contact hours, language — if other than German)

V + R (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) or b) talk (approx. 30 minutes) or c) oral examination of one candidate each or oral examination in groups (approx. 30 minutes) or d) project report (approx. 10 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Nanostructure Technology (2008)
Bachelor' degree (1 major) Nanostructure Technology (2007)
Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Organic Semiconductor			11-OHL-092-m01
Module coordinator		**Module offered by**	
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Admission prerequisite to assessment: successful completion of approx. 50% of exercises. Certain prerequisites must be met to qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the course. Registration for the course will be considered a declaration of will to seek admission to assessment. If students have obtained the qualification for admission to assessment over the course of the semester, the lecturer will put their registration for assessment into effect. Students who meet all prerequisites will be admitted to assessment in the current or in the subsequent semester. For assessment at a later date, students will have to obtain the qualification for admission to assessment anew.	

Contents

Physical principles of organic semiconductors, molecular and polymer electronics and sensor technology, applications.

Intended learning outcomes

The students have advanced knowledge of organic semiconductors.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) or b) oral examination of one candidate each or oral examination in groups (approx. 30 minutes per candidate, for modules with less than 4 ECTS credits approx. 20 minutes) or c) project report (approx. 10 pages, time to complete: 1 to 4 weeks) or d) presentation/seminar presentation (approx. 30 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Bachelor' degree (1 major) Physics (2010)
Bachelor' degree (1 major) Physics (2012)
Master's degree (1 major) Physics (2010)
Master's degree (1 major) Physics (2011)
Master's degree (1 major) Technology of Functional Materials (2010)

Master's degree (1 major) Technology of Functional Materials (2009)
Master's degree (1 major) Nanostructure Technology (2011)
Master's degree (1 major) Nanostructure Technology (2010)
Master's degree (1 major) FOKUS Physics - Nanostructuring Technology (2010)
Master's degree (1 major) FOKUS Physics (2010)
Master's degree (1 major) FOKUS Physics (2011)
Master's degree (1 major) Functional Materials (2012)

Module title			Abbreviation
Polymeric Materials 1: Technology of Modifying Polymers			08-PW1-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Polymer synthesis methods; the structure of polymers and polymer compounds; properties of polymers; technologies for the manufacturing of polymer compounds and components, procedures for the characterisation of polymer compounds and components.

Intended learning outcomes

Students have developed a knowledge of the special properties of polymers and polymer compounds (e.g. time and temperature-dependent viscoelastic behaviour). They have become familiar with the characteristics of important production technologies (polymer synthesis methods, compounding technologies, processing methods such as injection moulding) and understand the different ways of influencing the properties of materials and manufactured products. They have become familiar with ways to calculate complex flow conditions in polymer processing machines and tools.

Courses (type, number of weekly contact hours, language — if other than German)

V + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Polymeric Materials 2: Technology of Modifying Fillers for Polymers			08-PW2-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Principles of and technologies for the functionalisation of filler materials in order to modify polymers, interactions between filler materials and polymers, determination of the special properties of functionalised polymers (e.g. electrical behaviour, bactericidal behaviour) and influence of functionalisation on other properties (e.g. rheology, mechanical behaviour, colour, surface).

Intended learning outcomes

Students have become familiar with technologies for the functionalisation of filler materials. They have developed an awareness of the possibilities and problems associated with the modification of polymers as well as the interactions between filler materials and polymers. They know how to determine the special properties of functionalised polymers (e.g. electrical behaviour, bactericidal behaviour) and understand how other properties are influenced by functionalisation (e.g. rheology, mechanical behaviour, colour, surface).

Courses (type, number of weekly contact hours, language — if other than German)

V + P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Electrochemical Energy Storage and Conversion			08-EEW-092-m01
Module coordinator		**Module offered by**	
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Chemistry and application of: battery systems (aqueous and non-aqueous systems such as lead, nickel cadmium and nickel metal hydride, sodium sulphur, sodium nickel chloride, lithium ion accumulators), electrochemical double layer capacitors, redox-flow batteries, fuel cell systems (AFC, PEMFC, DMFC, PAFC, SOFC), solar cells (Si, CIS, CIGS, GaAs, organic and dye solar cell), thermoelectric devices.

Intended learning outcomes

Students have developed a knowledge of electrochemical energy storage and conversion and are able to apply that knowledge to research problems.

Courses (type, number of weekly contact hours, language — if other than German)

V + P + E (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes) and lab report (approx. 5 pages)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Structure and Properties of Modern Materials: Experiments and Simulations			08-MW-092-m01
Module coordinator			**Module offered by**
holder of the Chair of Chemical Technology of Material Synthesis			Chair of Chemical Technology of Material Synthesis
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

Material properties of metals and ceramics: correlation of structure/property relations through experiments and simulations.

Intended learning outcomes

Students gain an insight into the properties of modern materials: aerospace aluminium alloys and high-performance ceramics. They are introduced to measuring methods and calculation methods using numerical simulation. A special focus is on the relation between the micro/nanoscopic structure of materials and the resulting properties.

Courses (type, number of weekly contact hours, language — if other than German)

V + S (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

talk (approx. 45 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Module title			Abbreviation
Organic functional materials			08-OF-092-m01
Module coordinator		**Module offered by**	
lecturer of the seminar "Organische Funktionsmaterialien"		Institute of Organic Chemistry	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	--	

Contents

The module deals with specific topics in organic functional materials. The focus is on fundamental (photo)physical effects in organic molecular and polymeric semiconductors as well as their application in (opto)electronic components such as field effect transistors, organic light-emitting diodes, or organic solar cells as well as in nonlinear optics.

Intended learning outcomes

The students are able to explain fundamental (photo)physical processes in organic semiconductors. He/She can explain the synthesis of these semiconductor materials as well as their application in (opto)electronic components such as field effect transistors, organic light-emitting diodes or in organic photovoltaics as well as in nonlinear optics.

Courses (type, number of weekly contact hours, language — if other than German)

V (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (90 minutes)

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2009)

Thesis

(25 ECTS credits)

Module title			Abbreviation
Master-Thesis			08-MT-TF-092-m01
Module coordinator		**Module offered by**	
Dean of Studies Funktionswerkstoffe (Functional Materials)		Chair of Chemical Technology of Material Synthesis	
ECTS	**Method of grading**	**Only after succ. compl. of module(s)**	
25	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	graduate	Registration for assessment on a continuous basis as agreed upon with supervisor.	

Contents

Students will be expected to research and write on a defined topic in the technology of functional materials, adhering to the principles of good scientific practice.

Intended learning outcomes

Students are able to conduct research on a defined topic, adhering to the principles of good scientific practice, and to present the results of their work in written form.

Courses (type, number of weekly contact hours, language — if other than German)

no courses assigned

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written thesis
Language of assessment: German, English

Allocation of places

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Additional information

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Workload

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Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Technology of Functional Materials (2010)
Master's degree (1 major) Technology of Functional Materials (2009)