

Master - Advanced Functional Materials

English Version

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**Please refer to the official documents in
German language for reference.**

**Study regulations for the consecutive degree programme
Advanced Functional Materials
in English language leading to the Master of Science (M.Sc.)
at the Technische Universität Chemnitz
dated ...**

Based on Sect. 13(4) in conjunction with Sect. 36(1) of the Law on the Autonomy of Institutions of Higher Education in the Free State of Saxony (Sächsisches Hochschulfreiheitsgesetz - SächsHSFG) as promulgated on January 15, 2013 (SächsGVBl. p. 3), last amended by Article 11 of the law of April 29, 2015 (SächsGVBl. p. 349, 354), the faculty board of the Faculty of Natural Sciences at the Technische Universität Chemnitz enacts the following study regulations:

Table of contents

Part 1: General provisions

Section 1	Scope
Section 2	Start and duration of the programme
Section 3	Admission requirements
Section 4	Types of courses
Section 5	Objectives of the programme

Part 2: Organisation and contents of the programme

Section 6	Organisation of the programme
Section 7	Contents of the programme

Part 3: Procedures of the programme

Section 8	Course guidance
Section 9	Examinations
Section 10	Self-, distance-, and part time studies

Part 4: Final provisions

Section 11	Effective date and publication
Appendices:	1 Schedule of studies 2 Module descriptions

In these study regulations, grammatically masculine designations of persons equally apply to female and masculine persons. Women may use the the titles of offices and functions in these study regulations in grammatically feminine form. This applies accordingly to the awarding of university degrees, academic positions and titles.

Part 1 **General provisions**

Section 1 **Scope**

Based on the respective examination regulations in effect, the study regulations at hand direct the aims, contents, structure, procedure, and realisation of the degree programme Advanced Functional Materials leading to the Master of Science at the Faculty of Natural Sciences at the Technische Universität Chemnitz.

Section 2 **Start and duration of the programme**

- (1) The start of the programme is generally possible in the winter semester.
- (2) The programme has a standard period of study of four semesters (two years). The programme comprises modules with a total sum of 120 credit points (CP). This corresponds to an average workload of 3600 working hours.

Section 3 **Admission requirements**

- (1) The admission requirements for the master's degree programme are fulfilled, if a degree of higher education with professional qualification has been acquired at the Technische Universität Chemnitz in the bachelor's degree programme Chemistry or in the bachelor's degree programme Physics or in an equivalent study programme concerning contents, and if knowledge of English at the level B2 of the Common European Framework of Reference for Languages is proven.
- (2) The examining board decides about the equivalence as well as about the admission of other applicants.

Section 4 **Types of courses**

- (1) Types of courses may be: lecture (L), seminar (S), exercise (E), project (PR), colloquium (C), tutorial (T), practical course (P), or excursion (EC).
- (2) Tutorials supporting the students are set down in the module descriptions.
- (3) The courses are held in English. Additionally, modules with courses in German are offered in the elective area. It is set down in the module descriptions which courses are held in German.

Section 5 **Objectives of the programme**

- (1) In the study programme Advanced Functional Materials, knowledge about synthesis and production methods of functional materials and about the characterisation of their specific properties are conveyed. The students gain further experience in dealing with the typical chemical and physical methods of experimental and theoretical work in the interdisciplinary cross-sectional field.
- (2) The study programme Advanced Functional Materials is research-oriented. The handling of primary literature about current research activities on functional materials is an integral part of the programme. Projects in form of practical courses offer the opportunity to work on research-related problems.
- (3) Modules for enhanced language training (English for students with German as first language, German as a Foreign Language for international students) broaden the technical communication skills in international work groups.
- (4) In the master's thesis, students prove their ability to solve reasonably complex scientific tasks under supervision. This promotes the competence in scientific cooperation.

Part 2 **Organisation and contents of the programme**

Section 6 **Organisation of the programme**

- (1) 120 CP are awarded during the programme, which are composed as follows:

1. Basic modules:

CH1 - Synthetic Methods in Chemistry

5 CP (compulsory module)

CH2 - Analytical Methods	5 CP (compulsory module)
CH3 - Sustainable Production Technologies	5 CP (compulsory module)
PH1 - Advanced Surfaces, Thin Films and Interfaces	5 CP (compulsory module)
PH2 - Semiconductor physics - Nano structures	5 CP (compulsory module)
PH3 - Photovoltaics with Nanotechnology	5 CP (compulsory module)
AFM1 - Facets of Materials Science	10 CP (compulsory module)

2. Specialisation modules:

AFM2 - Research Project	20 CP (compulsory module)
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From the following, modules amounting to a sum of 30 CP have to be chosen. To broaden the selection range, up to 32 CP may be chosen. Those additional credit points will not be counted as credits towards the degree. Upon application and on an individual basis, the examining board can authorise the choice of other suitable modules.

Students whose first language is not German and who can't show proof the level A1 of the Common European Framework of Reference for Languages, are obligated to take the following module:

WS1 – German as a Foreign Language I (Level A1)	4 CP (elective module)
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Students whose first language is not German and who can't show proof the level A2 of the Common European Framework of Reference for Languages, are obligated to take the following module:

WS2 – German as a Foreign Language II (Level A2)	4 CP (elective module)
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WCH1 - Colloids	5 CP (elective module)
WCH2 - Polymer Materials	5 CP (elective module)
WCH3 - Materials Technology	3 CP (elective module)
WCH4 - Processes and products of the chemical industry	5 CP (elective module)
WCH5 - Practice of electrochemical materials science	5 CP (elective module)
WCH6 - Functional Materials	5 CP (elective module)
WCH7 - Analytics of surfaces and colloids	3 CP (elective module)
WCH8 - Practical course for analytics of surfaces and colloids	3 CP (elective module)
WCH9 - Spectroelectrochemistry	3 CP (elective module)
WCH10 - Surface Spectroscopies	3 CP (elective module)
WCH11 - Heterogeneous Catalysis	5 CP (elective module)
WCH12 - Challenges for future energy concepts - Chemical energy conversion	5 CP (elective module)
WCH13 - Crystallography	5 CP (elective module)
WCH14 - The Energiewende	5 CP (elective module)
WPH1 - Nanophysics - Physics of mesoscopic systems	5 CP (elective module)
WPH2 - Microscopy and analysis on the nano scale	5 CP (elective module)
WPH3 - Polymer Physics	3 CP (elective module)
WPH4 - Modern Microscopy (AFM)	5 CP (elective module)
WPH5 - Theoretical Solid State Physics	5 CP (elective module)
WPH6 - Experimental Physics – Complex Materials	10 CP (elective module)
WMB1 - Surface and Interface Engineering	5 CP (elective module)
WET1 - Materials in micro and nano technologies	5 CP (elective module)
WMB2 - Printed Functionalities	5 CP (elective module)
WMB3 - Interface design for fibre-plastic composites	5 CP (elective module)
WMB4 - Electrochemical Coating	3 CP (elective module)
WMB5 - Innovative Materials Engineering	4 CP (elective module)
WMB6 - Rheology of Polymers	4 CP (elective module)
WMB7 - Biomaterials and materials for medical technology	4 CP (elective module)
WMB8 - Materials Engineering – Structure Formation Processes	3 CP (elective module)

Option only for students whose first language is not English and who haven't yet taken one of the modules German as a Foreign Language I (Level A1) or German as a Foreign Language II (Level A2). One of the following modules may be chosen:

WS3 - English in study-related and professional conversation I (Level B2)	4 CP (elective module)
WS4 - English in study-related and professional conversation III (Level C1)	4 CP (elective module)

Option only for students whose first language is not German and who haven't yet taken one of the modules German as a Foreign Language I (Level A1) or German as a Foreign Language II (Level A2). One of the following modules may be chosen:

WS5 - German as a Foreign Language III (Level B1)	4 CP (elective module)
WS6 - German as a Foreign Language IV (Level B2)	4 CP (elective module)
WS7 - German as a Foreign Language – Specialised Communication I (Level C1)	4 CP (elective module)

3. Module Master's Thesis:

AFM3 – Master's Thesis 30 CP (compulsory module)

(2) The recommended sequence of studies in the master's degree programme Advanced Functional Materials at the Technische Universität Chemnitz within the standard period of study results from the chronological outline in the schedule of studies (see appendix 1) and the modular structure of the programme.

Section 7 Contents of the programme

(1) In the master's degree programme Advanced Functional Materials, further knowledge, methods, and skills from the fields of Chemistry and Physics are conveyed to the students, qualifying them for interdisciplinary, research-oriented work in the area of materials science.

The master's degree programme comprises:

1. basic modules for obtaining a broad methodical knowledge about synthesis, production, and analytics of functional materials.
2. modules for obtaining experience in scientific practice by working on research-oriented problems in research and project practical courses, as well as by supervised work with primary literature about current research activities in the area of functional materials.
3. elective modules allowing for specialisation. This particularly includes choices illuminating the interface between scientific and technological approach to materials.
4. modules for enhanced language training (English or German as a Foreign Language).
5. completion of the master's thesis.

(3) Contents, aims, types of courses, credit points, examinations, as well as frequency and duration of the individual modules are displayed in the module descriptions (see appendix 2).

Part 3 Procedures of the programme

Section 8 Course guidance

(1) There is a subject-specific course guidance besides the Central Course Guidance at the Technische Universität Chemnitz. The faculty board of the Faculty of Natural Sciences entrusts a member of the faculty with conducting this guidance.

(2) It is recommended to make use of the course guidance particularly in the following cases:

1. prior to starting the study programme,
2. prior to a study visit abroad,
3. prior to a practical course,
4. in the event of a change of study programme or university,
5. after failed examinations.

Section 9 Examinations

The regulations about examinations are enclosed in the examination regulations for the degree programme Advanced Functional Materials leading to the Master of Science (M.Sc.) at the Technische Universität Chemnitz.

Section 10 Self-, distance-, and part time studies

(1) The students are expected to consolidate the contents of courses self-dependently and to prepare for the courses to be attended. The knowledge necessary for successfully completing the study programme will not only be obtained by attending courses, but will have to be supplemented by additional studies.

(2) Distance studies or part time studies are not intended.

Part 4
Final provisions

Section 11
Effective date and publication

The study regulations are applicable to those enrolled from the winter semester 2015/2016.

The study regulations take effect from the day after their publication in the Official Publications (Amtliche Bekanntmachungen) of the Technische Universität Chemnitz.

Issued on the basis of the decision of the faculty board of the Faculty of Natural Sciences from ... and the approval of the University Management of the Technische Universität Chemnitz from

Chemnitz, ...

The Rector
of the Technische Universität Chemnitz

Prof. Dr. Arnold van Zyl

Appendix 1: Consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)
SCHEDULE OF STUDIES

Modules	1st Semester	2nd Semester	3rd Semester	4th Semester	Workload Sum of credit points
1. Basic modules:					
CH1 - Synthetic Methods in Chemistry	150 WH 3 LH (S3) EX: oral exam				150 WH / 5 CP
CH2 - Analytical Methods	150 WH 3 LH (L2/S1) PEX: moderation EX: written exam				150 WH / 5 CP
CH3 - Sustainable Production Technologies		150 WH 4 LH (L2/S2) PEX: moderation EX: written exam			150 WH / 5 CP
PH1 - Advanced Surfaces, Thin Films and Interfaces	150 WH 4 LH (L2/T1/S1) PEX: presentation EX: oral exam				150 WH / 5 CP
PH2 - Semiconductor physics – Nano structures		150 WH 4 LH (L3/E1) EX: written exam			150 WH / 5 CP
PH3 - Photovoltaics with Nanotechnology			150 WH 3 LH (L2/E1) EX: oral exam		150 WH / 5 CP
AFM1 - Facets of Materials Science	50 WH 2 LH (S2) (Tutorial)	150 WH 3 LH (L2/S1) (Facets of Materials Science)	100 WH 2 LH (S2) (Sc. discussion of current areas of		300 WH / 10 CP

Appendix 1: Consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)
SCHEDULE OF STUDIES

		EX: written exam	research or Advanced Seminar)		
			EX: presentation		
2. Specialisation modules:					
AFM2 - Research Project			600 WH 18 LH (L2/S2/P14) EX: written report about the research project		600 WH / 20 CP
From the following, modules amounting to a sum of 30 CP have to be chosen. To broaden the selection range, up to 32 CP may be chosen. Those additional credit points will not be counted as credits towards the degree. Upon application and on an individual basis, the examining board can authorise the choice of other suitable modules.					
Students whose first language is not German and who can't show proof the level A1 of the Common European Framework of Reference for Languages, are obligated to take the following module:					
WS1 – German s a Foreign Language I (Level A1)	120 WH 4 LH (E4) CCA: written exam				120 WH / 4 CP
Students whose first language is not German and who can't show proof the level A2 of the Common European Framework of Reference for Languages, are obligated to take the following module:					
WS2 - German s a Foreign Language II (Level A2)	120 WH 4 LH (E4) CCA: written exam	or 120 WH 4 LH (E4) CCA: written exam			120 WH / 4 CP
WCH1 - Colloids	150 WH 4 LH (L2/P2) 2 EX: written exam, report about practical course		or 150 WH 4 LH (L2/P2) 2 EX: written exam, report about practical course		150 WH / 5 CP

Appendix 1: Consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)
SCHEDULE OF STUDIES

WCH2 – Polymer Materials		150 WH 4 LH (L2/S1/P1) PEX: successfully audited practical course EX: written exam			150 WH / 5 CP
WCH3 – Materials Technology	90 WH 2 LH (L2) EX: written exam		or: 90 WH 2 LH (L2) EX: written exam		90 WH / 3 CP
WCH4 - Processes and products of the chemical industry	150 WH 4 LH (L2/S2) PEX: presentation EX: written exam		or: 150 WH 4 LH (L2/S2) PEX: presentation EX: written exam		150 WH / 5 CP
WCH5 – Practice of electrochemical materials science	150 WH 4 LH (L2/P2) PEX: successfully audited practical course EX: oral exam		or: 150 WH 4 LH (L2/P2) PEX: successfully audited practical course EX: oral exam		150 WH / 5 CP
WCH6 – Functional materials		150 WH 4 LH (L2/P2) PEX: successfully audited practical course EX: oral exam			150 WH / 5 CP
WCH7 – Analytics of surfaces and colloids	90 WH 2 LH (S2) EX: written exam		or: 90 WH 2 LH (S2)		90 WH / 3 CP

Appendix 1: Consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)
SCHEDULE OF STUDIES

			EX: written exam		
WCH8 – Practical course for analytics of surfaces and colloids	90 WH 2 LH (P2) EX: report about the practical course		or: 90 WH 2 LH (P2) EX: report about the practical course		90 WH / 3 CP
WCH9 - Spectroelectrochemistry	90 WH 2 LH (L2) EX: oral exam		or: 90 WH 2 LH (L2) EX: oral exam		90 WH / 3 CP
WCH10 - Surface Spectroscopies	90 WH 2 LH (L2) EX: oral exam		or: 90 WH 2 LH (L2) EX: oral exam		90 WH / 3 CP
WCH11 - Heterogeneous Catalysis		150 WH 4 LH (L2/P2) PEX: successfully audited practical course EX: oral exam			150 WH / 5 CP
WCH12 - Challenges for future energy concepts - Chemical energy conversion		150 WH 3 LH (L2/S1) PEX: presentation during the seminar EX: oral exam			150 WH / 5 CP
WCH13 - Crystallography	150 WH 4 LH (L2/E2) EX: written exam		or: 150 WH 4 LH (L2/E2) EX: written exam		150 WH / 5 CP

Appendix 1: Consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)
SCHEDULE OF STUDIES

WCH14 - The Energiewende	150 WH 4 LH (L1/S1/P2) EX: presentation		or: 150 WH 4 LH (L1/S1/P2) EX: presentation		150 WH / 5 CP
WPH1 - Nanophysics – Physics of mesoscopic systems	150 WH 3 LH (L2/E1) EX: written exam		or: 150 WH 3 LH (L2/E1) EX: written exam		150 WH / 5 CP
WPH2 - Microscopy and analysis on the nano scale		150 WH 3 LH (L2/E1) EX: written exam			150 WH / 5 CP
WPH3 – Polymer Physics		90 WH 2 LH (L2) EX: oral exam			90 WH / 3 CP
WPH4 - Modern Microscopy (AFM)	75 WH 3 LH (L2/S1)	75 WH 3 LH (L2/S1) EX: oral exam			150 WH / 5 CP
WPH5 - Theoretical Solid State Physics	75 WH 3 LH (L2/S1)	75 WH 3 LH (L2/S1) EX: oral exam			150 WH / 5 CP
WPH6 – Experimental Physics – Complex Materials	150 WH 5 LH (L2/S2/S1)	150 WH 5 LH (L3/S1/S1) PEX: presentation during seminar EX: oral exam			300 WH / 10 CP
WMB1 - Surface and Interface Engineering		150 WH 4 LH (L2/S1/P1)			150 WH / 5 CP

Appendix 1: Consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)
SCHEDULE OF STUDIES

		PEX: presentation EX: written exam			
WET1 - Materials in micro and nano technologies	150 WH 4 LH (L2/E2) PEX: proof of exercises EX: written exam		oder: 150 WH 4 LH (L2/E2) PEX: proof of exercises EX: written exam		150 WH / 5 CP
WMB2 - Printed Functionalities		150 WH 3 LH (L2/P1) PEX: successfully audited practical course EX: written exam			150 WH / 5 CP
WMB3 – Interface design for fibre-plastic composites		150 WH 4 LH (L2/S1/P1) EX: written exam			150 WH / 5 CP
WMB4 - Electrochemical Coating	90 WH 2 LH (L1/E1) EX: oral exam		or: 90 WH 2 LH (L1/E1) EX: oral exam		90 WH / 3 CP
WMB5 - Innovative Materials Engineering		120 WH 3 LH (L2/P1) EX: written exam			120 WH / 4 CP
WMB6 – Rheology of Polymers	120 WH 2 LH (L2) EX: written exam		or: 120 WH 2 LH (L2) EX: written exam		120 WH / 4 CP

Appendix 1: Consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)
SCHEDULE OF STUDIES

WMB7 - Biomaterials and materials for medical technology		120 WH 3 LH (L2/E1) EX: written exam			120 WH / 4 CP
WMB8 – Materials Engineering – Structure Formation Processes		90 WH 2 LH (L2) EX: written exam			90 WH / 3 CP
Option only for students whose first language is not English and who haven't yet taken one of the modules German as a Foreign Language I (Level A1) or German as a Foreign Language II (Level A2). One of the following modules may be chosen:					
WS3 - English in study-related and professional conversation I (Level B2)	120 WH 4 LH (E4) CCA: written exam	or: 120 WH 4 LH (E4) CCA: written exam	or: 120 WH 4 LH (E4) CCA: written exam		120 WH / 4 CP
WS4 - English in study-related and professional conversation III (Level C1)	120 WH 4 LH (E4) 2 CCA: written exam, oral exam	or: 120 WH 4 LH (E4) 2 CCA: written exam, oral exam	or: 120 WH 4 LH (E4) 2 CCA: written exam, oral exam		120 WH / 4 CP
Option only for students whose first language is not German and who haven't yet taken one of the modules German as a Foreign Language I (Level A1) or German as a Foreign Language II (Level A2). One of the following modules may be chosen:					
WS5 - German as a Foreign Language III (Level B1)	120 WH 4 LH (E4) CCA: written exam	or: 120 WH 4 LH (E4) CCA: written exam	or: 120 WH 4 LH (E4) CCA: written exam		120 WH / 4 CP
WS6 - German as a Foreign Language IV (Level B2)	120 WH 4 LH (E4) CCA: written exam	or: 120 WH 4 LH (E4) CCA: written exam	or: 120 WH 4 LH (E4) CCA: written exam		120 WH / 4 CP

Appendix 1: Consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)
SCHEDULE OF STUDIES

WS7 - German as a Foreign Language – Specialised Communication I (Level C1)	120 WH 4 LH (E4) CCA: written exam	or: 120 WH 4 LH (E4) CCA: written exam	or: 120 WH 4 LH (E4) CCA: written exam		120 WH / 4 CP
3. Module Master's Thesis:					
AFM3 – Master's Thesis:				900 WH 30 LH (PR 30) 2 EX: master's thesis, presentation with discussion (colloquium)	900 WH / 30 CP
Total LH (exemplary for choice of WCH9, WCH14 and WPH1 in the 1 st semester of studies, WCH12, WPH2 and WS3 in the 2 nd semester of studies, and WCH10 in the 3 rd semester of studies)	21 LH	21 LH	25 LH	30 LH	97 LH
Total WH (exemplary for choice of WCH9, WCH14 and WPH1 in the 1 st semester of studies, WCH12, WPH2 and WS3 in the 2 nd semester of studies, and WCH10 in the 3 rd semester of studies)	890 WH	870 WH	940 WH	900 WH	3600 WH / 120 CP

EX	exam
PEX	pre-exam
T	tutorial
WH	working hours
CP	credit points
LH	lesson hours
L	lecture
CCA	creditable course achievement

S	seminar
E	exercise course
P	practical course
EC	excursion
C	colloquium
PR	project

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Basic module

Module number	CH1
Module title	Synthetic Methods in Chemistry
Responsible for the module	Professorships of Coordination Chemistry (for S1), Inorganic Chemistry (for S2), Polymer Chemistry (for S3)
Contents and qualification aims	<p>Contents: Basic principles of modern methods for chemical synthesis of materials will be treated and discussed by means of examples in current literature. These may include, e.g.:</p> <ul style="list-style-type: none"> a) inorganic materials by procedures like solid state synthesis, chemical vapour deposition, sol-gel process, nanoparticle synthesis, or hydrothermal synthesis b) polymers by procedures like addition polymerisation (radical, anionic, cationic) or polycondensation c) organic-inorganic hybrid materials by procedures like twin polymerisation <p>Qualification aims: The students will be familiar with various modern methods of synthesis for different classes of materials and can assess the pros and cons of synthesis strategies as well as identify fields of application for the methods.</p>
Types of courses	The module's type of course is the seminar. <ul style="list-style-type: none"> • S (S1): Synthetic Methods in Chemistry (1 LH) • S (S2): Synthetic Methods in Chemistry (1 LH) • S (S3): Synthetic Methods in Chemistry (1 LH)
Requirements for participation	Proficiency in the areas of general, inorganic, and organic chemistry
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	The module exam comprises: <ul style="list-style-type: none"> • a 30-minute oral exam about Synthetic Methods in Chemistry
Credit points and grades	5 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.
Frequency of the module	The module will be offered in every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Basic module

Module number	CH2
Module title	Analytical Methods
Responsible for the module	Professorship of Materials for Innovative Energy Concepts
Contents and qualification aims	<p><u>Contents:</u> During the lecture, important analytical methods including the underlying physical processes will be conveyed. The treated methods comprise volume methods, e.g. powder X-ray diffraction, as well as surface sensitive methods like photoelectron spectroscopy. For teaching the methods, the interactions of matter with electromagnetic radiation and particle radiation will initially be treated, in order to then systematically demonstrate the possibilities for characterisation derivable therefrom. On the one hand, the focus is on the different depths of information of the methods. On the other hand, the significance of a consistent model of the material to be characterised will be conveyed by various analytical methods.</p> <p><u>Qualification aims:</u> The students acquire a wide range of characterisation methods for solids, and a well-founded judgement of the respective results, taking the physical processes into account. During the accompanying seminar, the conveyed knowledge will be deepened and applied through case-studies of material characterisation in prepared and moderated discussions.</p>
Types of courses	<p>The module's types of courses are lecture and seminar.</p> <ul style="list-style-type: none"> • L: Analytical methods (2 LH) • S: Analytical methods (1 LH)
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • moderating a 30-minute discussion during the seminar under the guidance of the seminar leader
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 60-minute written exam about Analytical Methods
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Basic module

Module number	CH3
Module title	Sustainable Production Technologies
Responsible for the module	Professorship of Chemical Technology
Contents and qualification aims	<p>Contents: The module conveys an understanding of the conception of processes in the chemical industry that are modern, economically feasible, and sustainable. Initially, the principles of "green" or "sustainable chemistry" will be introduced and the possibilities and chances for chemistry presented. Based on that, the methods and tools of sustainable industrial chemistry are treated with the extended goal of process intensification. The demonstrated principles will be deepened by means of the detailed inspection of examples (use of membrane technologies, synthesis of certain basic chemicals by the chemical industry via sustainable processes, e.g. propylene oxide, phenol, biodiesel, etc.).</p> <p>Qualification aims: The students learn to regard knowledge about the production of basic chemicals under the aspect of a sustainable and resource-friendly interpretation of the processes. During the seminar included in the module, those skills will be applied and enhanced using selected examples in prepared and moderated discussions.</p>
Types of courses	<p>The module's types of courses are lecture and seminar.</p> <ul style="list-style-type: none"> • L: Sustainable Production Technologies (2 LH) • S: Sustainable Production Technologies (2 LH)
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • moderating a 30-minute discussion during the seminar under the guidance of the seminar leader
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Sustainable Production Technologies
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the summer semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Basic module

Module number	PH1
Module title	Advanced Surfaces, Thin Films and Interfaces
Responsible for the module	Professorship of Technical Physics
Contents and qualification aims	<p>Contents:</p> <ul style="list-style-type: none"> • vacuum technology • methods for the preparation of films • basics of crystallography in two dimensions, relaxation, reconstruction • elementary processes on the surface (adsorption, desorption, diffusion) • electronic surface states, image states • surface analysis I: diffraction methods • surface analysis II: electron spectroscopy • surface analysis III: microscopy • characterisation of thin films with ions • interfaces, quantum well states <p>Qualification aims: Introduction to modern surface physics, conveying the basic physical principles and concepts, interface effects, vacuum technology, and analytical methods.</p>
Types of courses	<p>The module's types of courses are lecture, tutorial, and seminar.</p> <ul style="list-style-type: none"> • L: Surfaces, Thin Films and Interfaces (2 LH) • T: Surfaces, Thin Films and Interfaces (1 LH) • S: Advanced Surfaces, Thin Films and Interfaces (1 LH)
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • a 30-minute presentation during the seminar Advanced Surfaces, Thin Films and Interfaces
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 20-minute oral exam about the module contents
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Basic module

Module number	PH2
Module title	Semiconductor physics - Nano structures
Responsible for the module	Professorship of Semiconductor Physics
Contents and qualification aims	<p>Contents: Semiconductor physics / Nano structures:</p> <ul style="list-style-type: none"> • survey of semiconductors • crystal structure, definition and terms • electronic band structure, calculations via pseudopotential methods • vibrational properties of semiconductors and electron-phonon interaction • electronic properties of defects, classification of defects, effective mass, doping • electrical transport phenomena, charge carrier mobility and scattering, temperature dependence, relaxation time • optical properties, dielectric function, phonon-polariton and lattice absorption, absorption by free charge carriers and shallow donors and acceptors • surface effects, -states and -reconstructions • quantum confinement effect on electrons and phonons in semiconductors • quantum wells, -wires, -dots, superlattice, applications • magnetic nano structures, spintronics <p>Qualification aims: Understanding of the basic principles and methods of semiconductor physics and the confinement effects in nano structures</p>
Types of courses	<p>The module's types of courses are lecture and exercise.</p> <ul style="list-style-type: none"> • L: Semiconductor physics / Nano structures (3 LH) • E: Semiconductor physics / Nano structures (1 LH)
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Semiconductor physics / Nano structures
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Basic module

Module number	PH3
Module title	Photovoltaics with Nanotechnology
Responsible for the module	Professorship of Optics and Photonics of Condensed Matter, in particular Sensor Systems and Analytics
Contents and qualification aims	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • absorption and emission of radiation in semiconductors • generation and recombination of charge carriers in semiconductors • electrical and optical parameters of solar cells • understanding of theoretical and practical limits of energy conversion efficiency • concepts for the increase in energy conversion efficiency of photovoltaic cells <p><u>Qualification aims:</u> This module conveys knowledge about the basic working principles of photovoltaic cells to the engineers-to-be, including general and practical limitations, as well as concepts for the increase in energy conversion efficiency.</p>
Types of courses	The module's types of courses are lecture and seminar. <ul style="list-style-type: none"> • L: Photovoltaics with Nanotechnology (2 LH) • S: Photovoltaics with Nanotechnology (1 LH)
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	The module exam comprises: <ul style="list-style-type: none"> • a 30-minute oral exam about Photovoltaics with Nanotechnology
Credit points and grades	5 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Basic module

Module number	AFM1
Module title	Facets of Materials Science
Responsible for the module	Professorship of Materials for Innovative Energy Concepts
Contents and qualification aims	<p>Contents: To allow for the rapid development within the broad range of materials science, this module will be organised as a series of lectures by experts with an up-to-date topic of research in the area of modern functional materials. The lectures will comprise an introduction to the respective topic, the underlying chemical and physical processes in or on the material, its synthesis and characterisation. The main focus will be on the relationship between structure and properties as well as on strategies for material optimisation. Attention will finally be paid to existent challenges in the application. Following the lecture, there will be a discussion with the expert, responding to the students' questions and suggestions.</p> <p>Furthermore, the students will practise working with primary literature in materials science and presenting a complex scientific topic. Depending on their preferences, the students may choose between the more chemically oriented seminar "Scientific discussion of current areas of research" or the "Advanced Seminar" focussing on physical aspects.</p> <p>Alongside the technical training, the tutorial enables discussing aspects of good scientific practice and of the presentation of scientific results. In order to guard against difficulties in technical understanding and communication between students from various disciplines, well-known cases arising from the respective faculty cultures, e.g. different use of technical terms or dissimilarly coined prior knowledge, will be addressed. Tutorials will alternately be held by the Institute of Physics and the Institute of Chemistry to convey broad understanding for the respective other department to the students.</p> <p>Qualification aims: Thanks to the experts' lectures in varying areas of research, the students receive a broad education concerning different classes of materials as well as applications. The subsequent opportunity for discussion with the lecturer enables to apply and deepen prior knowledge. Additionally, the discussion contributes significantly to learning about the complex structure of professional discussions.</p> <p>The students obtain solid knowledge about the elaboration and presentation of scientific topics. They learn to become quickly and thoroughly acquainted with unfamiliar subject areas and gain insight into advanced topics in Chemistry and Physics.</p> <p>The tutorial sensitises the students to cultural differences between the disciplines and teaches them to handle those constructively.</p> <p>Proficiency in processing and presenting complex contexts in limited time is deepened.</p>
Types of courses	<p>The module's types of courses are lecture and seminar:</p> <ul style="list-style-type: none"> • S: Tutorial Chemistry meets Physics - Physics meets Chemistry (CPPC) (2 LH) • L: Facets of Materials Science (2 LH) • S: Facets of Materials Science (1 LH) <p>One of the following courses has to be chosen:</p> <ul style="list-style-type: none"> • S: Scientific discussion of current areas of research (2 LH) • S: Advanced Seminar (2 LH)
Requirements for participation	none

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	The module exam comprises two parts. In detail, the following exams have to be taken: <ul style="list-style-type: none"> • a 60-minute written exam about the lecture Facets of Materials Science • a 20-minute presentation during the seminar Scientific discussion of current areas of research or the Advanced Seminar
Credit points and grades	10 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations. Examinations: <ul style="list-style-type: none"> • written exam about the lecture Facets of Materials Science, weighting 1, passing required. • presentation during the seminar Scientific discussion of current areas of research or the Advanced Seminar, weighting 1, passing required.
Frequency of the module	The module will be offered in every academic year.
Workload	The module comprises a student's total workload of 300 WH.
Duration of the module	Presuming a proper course of studies, the module extends over three semesters.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Specialisation module

Module number	AFM2
Module title	Research Project
Responsible for the module	Dean of Studies Advanced Functional Materials of the Faculty of Natural Sciences
Contents and qualification aims	<p>Contents: Scientific assignment focussed on materials science in the work group of a professor / junior professor of the Faculty of Natural Sciences, a professor / junior professor of the TU Chemnitz or another university, a non-university research institution or a research and development department of an industrial company inland or abroad.</p> <p>Qualification aims: The students show the ability to work on preset scientific questions concerning materials science. The scientific work will be conducted, evaluated, documented, and presented self-dependently. The students gain the ability to become acquainted with new topics and learn to handle modern scientific equipment. Regular attendance at the work group's seminar promotes the skills in scientific discourse.</p>
Types of courses	<p>The module's types of courses are lecture, seminar, and practical course:</p> <ul style="list-style-type: none"> • P: practical research (14 LH) • S: work group seminar alongside the practical research (2 LH) <p>One of the following lectures has to be chosen:</p> <ul style="list-style-type: none"> • L: Physical Colloquium (2 LH) • L: Chemical Colloquium (2 LH)
Requirements for participation	There will be safety instructions by the respective work group's person responsible prior to the start of laboratory work. Attendance at these instructions is obligatory. Basic knowledge about the working methods of the work group chosen for the practical course is a precondition.
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a written report about the research project (approx. 30 pages long). The report may be submitted in either German or English.
Credit points and grades	20 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.
Frequency of the module	The module will be offered in every academic year.
Workload	The module comprises a student's total workload of 600 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WS1
Module title	German as a Foreign Language I (Level A1)
Responsible for the module	Head of Department German as a Foreign Language at the Foreign Language Centre
Contents and qualification aims	<p><u>Contents:</u></p> <ul style="list-style-type: none"> teaching basic knowledge of German (vocabulary, grammar, phonetics) introduction and practising of vocabulary about simple topics, e.g. family, shopping, living acquiring first grammatical structures and rules, e.g. articles and declension of nouns, modal verbs, negation, verb forms in present and perfect tense phonetic exercises <p>The training follows the language competence level A1 of the Common European Framework of Reference for Languages (CEFR).</p> <p><u>Qualification aims:</u></p> <ul style="list-style-type: none"> understanding familiar, everyday expressions and grasping basic sentences communicating simple phrases and sentences answering easy questions about family, education, and studies <p>The completion of the module corresponds to the language competence level A1 of the Common European Framework of Reference for Languages (CEFR).</p>
Types of courses	<p>The module's type of course is the exercise.</p> <ul style="list-style-type: none"> E: Course 1 (4 LH)
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <p>Creditable course achievement:</p> <ul style="list-style-type: none"> a 90-minute written exam about Course 1 <p>The exam needs to be graded with at least "sufficient" in order to be credited.</p>
Credit points and grades	<p>4 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in every semester.
Workload	The module comprises a student's total workload of 120 WH. (60 hours of contact and 60 hours of self-study).

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Duration of the module	Presuming a proper course of studies, the module extends over one semester.
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Specialisation module

Module number	WS2
Module title	German as a Foreign Language II (Level A2)
Responsible for the module	Head of Department German as a Foreign Language at the Foreign Language Centre
Contents and qualification aims	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • broadening and solidifying the vocabulary, e.g. about topics like education, activities, hobbies, recreation, and job • discovery and practice of new grammatical structures, e.g. separable and non-separable verbs, reflexive verbs, consolidation of the tenses, exercises about word order in different sentence constructions • exercises of German phonetics <p>The training follows the language competence level A2 of the Common European Framework of Reference for Languages (CEFR).</p> <p><u>Qualification aims:</u></p> <ul style="list-style-type: none"> • understanding of commonly used expressions related to areas of immediate significance • communication about familiar and common topics through simple and direct exchange of information <p>The completion of the module corresponds to the language competence level A2 of the Common European Framework of Reference for Languages (CEFR).</p>
Types of courses	<p>The module's type of course is the exercise.</p> <ul style="list-style-type: none"> • E: Course 2 (4 LH)
Requirements for participation	Completed previous Course 1 or placement test (recommendation of qualification)
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <p>Creditable course achievement:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Course 2 <p>The exam needs to be graded with at least "sufficient" in order to be credited.</p>
Credit points and grades	<p>4 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in every semester.
Workload	The module comprises a student's total workload of 120 WH. (60 hours of contact and 60 hours of self-study).
Duration of the module	Presuming a proper course of studies, the module extends over one se-

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

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Specialisation module

Module number	WCH1
Module title	Colloids
Responsible for the module	Professorship of Physical Chemistry
Contents and qualification aims	<p>Contents:</p> <ul style="list-style-type: none"> • colloids and dispersions • preparation of dispersions by fragmentation • preparation of dispersions by controlled precipitation • Aggregations of defined size in thermodynamic equilibrium with a bulk phase • nucleation & growth • Smoluchowski's aggregation kinetics • spherulitic growth • mechanisms of the collapse of dispersions: creaming/sedimenting, coalescence, aggregation, Ostwald ripening • measures for the stabilisation of dispersions • characterisation of dispersions • particle size measurements • preparation and characterisation of porous compounds • practical experiments in colloid chemistry <p>Qualification aims: Students have the ability to</p> <ul style="list-style-type: none"> • systematically explain natural phenomena, technical processes, and chemical reactions featuring dispersions • identify dispersions and classify them • prepare dispersions using different methods, recognise the strengths and weaknesses of each method and choose the respective best method for the preparation of a dispersion under given conditions • stabilise dispersions using different methods, recognise the strengths and weaknesses of each method and choose the respective best method or combination of methods for the stabilisation of a dispersion under given conditions • characterise dispersions using different methods • determine particle size and particle size distribution and choose the respective best method • independently derive further physical-chemical principles from basic mathematically describable knowledge
Types of courses	<p>The module's types of courses are lecture and practical course.</p> <ul style="list-style-type: none"> • L: Colloids (2 LH) • P: Colloids (2 LH) <p>The courses will be held in German.</p>
Requirements for participation	There will be safety instructions / an introduction to the practical course prior to the practical course itself. Attendance is obligatory (see "Allgemeine Laborordnung" – general laboratory rules – of the Institute of Chemistry).
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Module exam	The module exam comprises two parts. In detail, the following exams have to be taken: <ul style="list-style-type: none"> • a 120-minute written exam about the lecture Colloids • a report about the practical course Colloids (approx. 20 pages long)
Credit points and grades	5 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations. Examinations: <ul style="list-style-type: none"> • written exam about the lecture Colloids, weighting 1 – passing required • report about the practical course Colloids, weighting 1 – passing required
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WCH2
Module title	Polymer Materials
Responsible for the module	Professorship of Polymer Chemistry
Contents and qualification aims	<p>Contents: The module substantiates knowledge about synthesis, structure and material properties of macromolecular substances and polymer hybrid materials. This knowledge is deepened by information about ring-opening polymerisation, controlled polymer synthesis on interfaces and surfaces, sol-gel processes, specialty polymers like polyelectrolytes, conductive polymers, branched or cross-linked polymer structures, block copolymers, and the application of polymers for nano structuring and synthesis of hybrid materials and composites.</p> <p>Qualification aims: The students learn about the application of different synthesis types and methods of macromolecular chemistry for the preparation of polymers with well-defined properties for specific uses. They will self-dependently be able to theoretically devise synthetics and polymer substances for assimilated solutions and design pathways for their experimental realisation and analytics.</p>
Types of courses	<p>The module's types of courses are lecture, seminar, and practical course.</p> <ul style="list-style-type: none"> • L: Polymer Materials (2 LH) • S: Polymer Materials (1 LH) • P: Polymer Materials (1 LH) <p>The courses will be held in German.</p>
Requirements for participation	There will be safety instructions / an introduction to the practical course prior to the practical course itself. Attendance is obligatory (see "Allgemeine Laborordnung" – general laboratory rules – of the Institute of Chemistry).
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • successfully audited practical course Polymer Materials
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Polymer Materials
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the summer semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WCH3
Module title	Materials Technology
Responsible for the module	Professorship of Chemical Technology
Contents and qualification aims	<p>Contents:</p> <ul style="list-style-type: none"> • basic knowledge about understanding technological materials and their surfaces • nomenclature of materials in technology • structure and property correlation • characterisation and testing of materials • survey / fields of application / stresses and strains / operating conditions • applications / use in laboratories, technical centres, chemical industry, apparatus construction, process technology <p>Qualification aims: In this elective module, the students gain basic knowledge about metallic and non-metallic materials, about the correlation between structure and material properties, selection and application of materials, limitations of use, and about the influence of various treatments on the material properties and material surfaces.</p>
Types of courses	<p>The module's type of course is the lecture.</p> <ul style="list-style-type: none"> • L: Materials Technology (2 LH) <p>The course will be held in German.</p>
Requirements for participation	none
Applicability of the module	The module will be offered for students without profound knowledge in chemistry.
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Materials Technology
Credit points and grades	<p>3 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 90 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WCH4
Module title	Processes and Products of the Chemical Industry
Responsible for the module	Professorship of Chemical Technology
Contents and qualification aims	<p>Contents: The module conveys an understanding of chemical, technical, economical, ecological, and social aspects in the chemical industry and follows production lines from raw material to product. The lecture's emphasis will be on the chemical industry's raw material base and on basic chemicals. During a seminar, the students will present selected applications and end-products whose pre-products are manufactured from basic chemicals by the chemical industry, e.g. superabsorbents (diapers), car finish, rubber (car tyres) or liquid crystals.</p> <p>Qualification aims: The students learn about economical correlations and aspects of application technology of the chemical industry. Innovative and creative thinking is promoted and puts the students in a position to apply themselves actively in future operating procedures and the development of new products.</p>
Types of courses	<p>The module's types of courses are lecture and seminar.</p> <ul style="list-style-type: none"> • L: Processes and Products of the Chemical Industry (2 LH) • S: Processes and Products of the Chemical Industry (2 LH) <p>The courses will be held in German.</p>
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • a 20-minute presentation during the seminar Processes and Products of the Chemical Industry
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Processes and Products of the Chemical Industry
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Specialisation module

Module number	WCH5
Module title	Practice of Electrochemical Materials Science
Responsible for the module	Professorship of Physical Chemistry/Electrochemistry
Contents and qualification aims	<p><u>Contents:</u></p> <p>Lecture Electrochemical Materials Science</p> <ul style="list-style-type: none"> • materials (basic materials, compounds, technological materials) in inorganic and organic chemistry and their electrochemical processes for synthesis and modification are introduced • electrochemical processes are compared with thermal and mechanical processes <p>Practical course Electrochemical Materials Science</p> <ul style="list-style-type: none"> • synthesis and characterisation of conductive polymers • corrosion and protection against corrosion • galvanic surface modification <p><u>Qualification aims:</u> The students are enabled to properly assess and classify the economic significance and the potential for development of processes of electrochemical material production and treatment.</p>
Types of courses	<p>The module's types of courses are lecture and practical course.</p> <ul style="list-style-type: none"> • L: Electrochemical Materials Science (2 LH) • P: Electrochemical Materials Science (2 LH) <p>The courses will be held in German.</p>
Requirements for participation	<p>There will be safety instructions / an introduction to the practical course according to the Ordinance on Hazardous Substances prior to the practical course itself. Attendance is obligatory (see "Allgemeine Labordnung" – general laboratory rules – of the Institute of Chemistry).</p>
Applicability of the module	<p>Master's and bachelor's programmes Mechanical Engineering, Physics, Computational Science</p>
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • successfully audited practical course Electrochemical Materials Science
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 30-minute oral exam about Electrochemical Materials Science
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	<p>The module will be offered in the winter semester of every academic year.</p>
Workload	<p>The module comprises a student's total workload of 150 WH.</p>
Duration of the module	<p>Presuming a proper course of studies, the module extends over one semester.</p>

Specialisation module

Module number	WCH6
Module title	Functional Materials
Responsible for the module	Professorship of Coordination Chemistry
Contents and qualification aims	<p><u>Contents:</u> The module conveys knowledge about the synthesis, structure, characterisation, and potential application of selected functional materials from various areas of inorganic chemistry and organic-inorganic hybrid materials. The materials discussed include, e.g., zeolites, coordination polymers and MOFs (Metal Organic Frameworks), inorganic polymers, porous metal oxides, SAMs (Self-assembled monolayers), metal-oxo clusters, and selected hybrid materials. Besides classic methods of synthesis like high-temperature synthesis of solids or synthesis via chemical transport reaction, production processes like, e.g., the hydrolytic and non-hydrolytic sol-gel process, the hydrothermal process, the microwave assisted synthesis, and the MOCVD process (Metal Organic Vapor Deposition) will be treated. During the practical work, selected methods of synthesis will be tested and the materials obtained will be characterised, using for example BET analysis, IR spectroscopy, DTA-TG, and X-ray diffraction.</p> <p><u>Qualification aims:</u> The students are enabled to describe structural setup and function of inorganic materials and organic-inorganic hybrid materials. They command modern synthesis techniques and are able to apply these techniques to the preparation of new compounds. The students can interpret and evaluate the results of various methods for structural analysis of functional materials.</p>
Types of courses	<p>The module's types of courses are lecture and practical course.</p> <ul style="list-style-type: none"> • L: Functional Materials (2 LH) • P: Functional Materials (2 LH) <p>The courses will be held in German.</p>
Requirements for participation	There will be safety instructions / an introduction to the practical course according to the Ordinance on Hazardous Substances prior to the practical course itself. Attendance is obligatory (see "Allgemeine Labordnung" – general laboratory rules – of the Institute of Chemistry).
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • successfully audited practical course Functional Materials
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 30-minute oral exam about Functional Materials

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Credit points and grades	5 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.
Frequency of the module	The module will be offered in the summer semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WCH7
Module title	Analytics of Surfaces and Colloids
Responsible for the module	Professorship of Physical Chemistry
Contents and qualification aims	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • analytics of surfaces of condensed phases • analytics of interfaces between condensed phases • imaging interface analytics • colloid analytics <p><u>Qualification aims:</u> The students are enabled to answer to issues about analytics of surfaces and colloids by choosing and conducting appropriate methods of analysis.</p>
Types of courses	<p>The module's type of course is the seminar.</p> <ul style="list-style-type: none"> • S: Analytics of Surfaces and Colloids (2 LH) <p>The course will be held in German.</p>
Requirements for participation	none
Applicability of the module	for all master's programmes of the TU Chemnitz
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Analytics of Surfaces and Colloids
Credit points and grades	<p>3 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the winter semester of every other academic year.
Workload	The module comprises a student's total workload of 90 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WCH8
Module title	Practical Course Analytics of Surfaces and Colloids
Responsible for the module	Professorship of Physical Chemistry
Contents and qualification aims	<p><u>Contents:</u></p> <ul style="list-style-type: none"> analytics of surfaces of condensed phases and of interfaces between condensed phases colloid analytics <p><u>Qualification aims:</u> The students are enabled to answer to issues about analytics of surfaces and colloids by choosing and conducting appropriate methods of analysis.</p>
Types of courses	<p>The module's type of course is the practical course.</p> <ul style="list-style-type: none"> P: Analytics of Surfaces and Colloids (2 LH)
Requirements for participation	There will be safety instructions / an introduction to the practical course prior to the practical course itself. Attendance is obligatory (see "Allgemeine Laborordnung" – general laboratory rules – of the Institute of Chemistry).
Applicability of the module	for all master's programmes of the TU Chemnitz
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> a report about the practical course Analytics of Surfaces and Colloids (approx. 20 pages long)
Credit points and grades	<p>3 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the winter semester of every other academic year.
Workload	The module comprises a student's total workload of 90 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WCH9
Module title	Spectroelectrochemistry
Responsible for the module	Professorship of Physical Chemistry/Electrochemistry
Contents and qualification aims	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • possibilities and limitations of classic methods in electrochemistry • sensors and signals • ex situ techniques • in situ vibrational spectroscopies • optical spectroscopies • mass spectroscopy • Mössbauer spectroscopy <p><u>Qualification aims:</u> The students are enabled to choose and apply spectroscopic methods for electrochemical tasks and to critically evaluate the obtained results.</p>
Types of courses	The module's type of course is the lecture. • L: Spectroelectrochemistry (2 LH)
Requirements for participation	Basics of spectroscopic methods and structure determination (see, e.g. module BA-SS Spectroscopic Methods and Structure Determination of the bachelor's programme Chemistry) are assumed to be known.
Applicability of the module	Bachelor's and master's programmes Mechanical Engineering, Physics, Computational Science
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	The module exam comprises: <ul style="list-style-type: none"> • a 30-minute oral exam about Spectroelectrochemistry
Credit points and grades	3 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 90 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WCH10
Module title	Surface Spectroscopies
Responsible for the module	Professorship of Physical Chemistry/Electrochemistry
Contents and qualification aims	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • on the borders of solid material: surface properties • terms and definitions • sensors and signals on surfaces • electron spectroscopies • vibrational spectroscopies • mass spectroscopy • Mössbauer spectroscopy <p><u>Qualification aims:</u> The students are enabled to choose and apply spectroscopic methods for tasks in surface science and to critically evaluate the obtained results.</p>
Types of courses	The module's type of course is the lecture. <ul style="list-style-type: none"> • L: Surface Spectroscopies (2 LH)
Requirements for participation	Basics of spectroscopic methods and structure determination (see, e.g. module BA-SS Spectroscopic Methods and Structure Determination of the bachelor's programme Chemistry) are assumed to be known.
Applicability of the module	Bachelor's and master's programmes Mechanical Engineering, Physics, Computational Science
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	The module exam comprises: <ul style="list-style-type: none"> • a 30-minute oral exam about Surface Spectroscopies
Credit points and grades	3 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 90 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WCH11
Module title	Heterogeneous Catalysis
Responsible for the module	Professorship of Chemical Technology
Contents and qualification aims	<p>Contents: During the lecture, heterogeneous catalysis in terms of a multiscale approach will be taught on all relevant scales:</p> <ul style="list-style-type: none"> • energetic, steric, and electronic aspects of molecules' interaction with the surfaces of solids • microkinetics of heterogeneously catalysed reactions (Hougen-Watson rate equations) • heat and mass transport on the catalyst pellet (macrokinetics) • reactor modelling for heterogeneously catalysed processes • deactivation in heterogeneously catalysed processes • catalyst production <p>The lecture's contents will be deepened and the theoretical basics applied in the course of two practical experiments (ignition and quenching of catalysts, activity of heterogeneous catalysts).</p> <p>Qualification aims: The students acquire a basic understanding of heterogeneous catalysis on all relevant scales (molecular scale, pellet, reactor). This basic understanding is a precondition for rational development of catalysts in the laboratory and the transfer of results to a technical reactor.</p>
Types of courses	<p>The module's types of courses are lecture and practical course.</p> <ul style="list-style-type: none"> • L: Heterogeneous Catalysis (2 LH) • P: Heterogeneous Catalysis (2 LH) <p>The courses will be held in German.</p>
Requirements for participation	<p>The contents of module WCH4 - Processes and Products of the Chemical Industry are assumed to be known.</p> <p>There will be safety instructions / an introduction to the practical course according to the Ordinance on Hazardous Substances prior to the practical course itself. Attendance is obligatory (see "Allgemeine Labordnung" – general laboratory rules – of the Institute of Chemistry).</p>
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • successfully audited practical course Heterogeneous Catalysis
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 30-minute oral exam about Heterogeneous Catalysis
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the summer semester of every academic year.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WCH12
Module title	Challenges for future energy concepts - Chemical energy conversion
Responsible for the module	Honorary Professorship of Computer Assisted Quantum Chemistry
Contents and qualification aims	<p>Contents: During the lecture, the most important processes of chemical (and physical) energy conversion and storage will be treated: batteries, fuel cells, electrolyzers, and solar cells. The topics of chemical basics of catalysis, electrocatalysis, and photocatalysis will also be considered. The focus is on the challenges concerning chemical aspects and materials science, but the economic and social context will also be referred to.</p> <p>Qualification aims: The students know fundamental principles and processes of chemical energy conversion and storage. They understand the functionality and limitations of systems like fuel cells, batteries, or electrolyzers, and have acquired an overview of economic and social aspects of energy conversion.</p>
Types of courses	<p>The module's types of courses are lecture and seminar.</p> <ul style="list-style-type: none"> • L: Challenges for future energy concepts (2 LH) • S: Challenges for future energy concepts (1 LH)
Requirements for participation	Basic knowledge of general, inorganic, and organic chemistry
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • a 30-minute presentation during the seminar Challenges for future energy concepts
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 15-minute oral exam about Challenges for future energy concepts
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WCH13
Module title	Crystallography
Responsible for the module	Professorship of Materials for Innovative Energy Concepts
Contents and qualification aims	<p>Contents: Crystalline solids play an important role, in materials science as well as in application. This module imparts profound crystallographic knowledge to the students to enable them to work on materials-related issues. Furthermore, the crystallographic standard reference works and data bases will be introduced. The accompanying exercise course facilitates the consolidation of acquired knowledge using examples with practical relevance.</p> <p>Qualification aims: The students know how to use the standard reference works and can therefore work self-dependently on crystallographic issues. The exercise course instructs how to critically evaluate experimental results, enabling the students to identify mistakes of their own.</p>
Types of courses	<p>The module's types of courses are lecture and exercise.</p> <ul style="list-style-type: none"> • L: Crystallography (2 LH) • E: Crystallography (2 LH)
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Crystallography
Credit points and grades	5 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WCH14
Module title	The Energiewende
Responsible for the module	Professorship of Materials for Innovative Energy Concepts
Contents and qualification aims	<p>Contents: The Energiewende, the transition from fossil fuels to renewable and sustainable energy sources, will present a central field of work for scientists and industry in the coming decades. The module demonstrates different scenarios and evaluates them considering scientific, social, and economic aspects. The complexity of the transition is conveyed to the students and weak spots of the different scenarios are identified. In the accompanying seminar, the students develop new approaches for the various weak spots on the basis of current literature. By means of reproducing sustainable energy economics in the practical course, the complexity will be conveyed in a practical way and new approaches can be directly put to the test.</p> <p>Qualification aims: Communicating the extensive facets of the Energiewende. Raising the students' awareness for existing weak spots to initiate a qualified discussion in society. Developing and testing new approaches for the Energiewende by means of seminar and practical course.</p>
Types of courses	<p>The module's types of courses are lecture, seminar, and practical course.</p> <ul style="list-style-type: none"> • L: The Energiewende (1 LH) • S: The Energiewende (1 LH) • P: The Energiewende (2 LH)
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 30-minute presentation during the seminar The Energiewende
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WPH1
Module title	Nanophysics - Physics of mesoscopic systems
Responsible for the module	Professorship of Solid Surfaces Analysis
Contents and qualification aims	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • introduction • preparation of nanostructures • some basics about physics of surfaces and interfaces • electronic states and charge transfer in nanostructures • optical effects on a nm-scale • magnetic effects on a nm-scale • outlook <p><u>Qualification aims:</u> Understanding the basic physical principles as well as fundamental effects on the nanoscale, i.e. in the transition zone between classical and quantum physics; acquisition of the ability for interdisciplinary communication in this area of expertise.</p>
Types of courses	<p>The module's types of courses are lecture and exercise.</p> <ul style="list-style-type: none"> • L: Nanophysics - Physics of mesoscopic systems (2 LH) • E: Nanophysics - Physics of mesoscopic systems (1 LH)
Requirements for participation	It is recommended to take the module in combination with the module Microscopy and analysis on the nano scale.
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 120-minute written exam about Nanophysics - Physics of mesoscopic systems
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WPH2
Module title	Microscopy and analysis on the nano scale
Responsible for the module	Professorship of Solid Surfaces Analysis
Contents and qualification aims	<p>Contents:</p> <ul style="list-style-type: none"> • introduction • microscopy in position space • diffraction techniques • spectroscopy of electronic and vibronic states • sample preparation • data and image processing • simulation processes • outlook <p><u>Qualification aims:</u> Understanding the functional principles and the physical background of modern microscopic and analytical methods and the corresponding pre- and post-processing techniques; based thereupon, developing an understanding of the appropriate choice and combination of these methods.</p>
Types of courses	<p>The module's types of courses are lecture and exercise.</p> <ul style="list-style-type: none"> • L: Microscopy and analysis on the nano scale (2 LH) • E: Microscopy and analysis on the nano scale (1 LH)
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 120-minute written exam about Microscopy and analysis on the nano scale
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WPH3
Module title	Polymer Physics
Responsible for the module	Professorship of Chemical Physics
Contents and qualification aims	<p><u>Contents:</u> The lecture provides an introduction to the physics of polymers. The behaviour of single chains, collective behaviour (rubber elasticity, rheology), polymer solutions, polymer blends, block copolymers, and semi-crystalline polymers will be treated. Experiments, characterisation methods, and theoretical models will be presented.</p> <p><u>Qualification aims:</u> The students are enabled to describe the structural setup of polymers on different length scales and the resulting properties. They command analytic methods and polymer models suitable for characterising and simulating macromolecules. The students obtain an understanding of structure formation in polymers.</p>
Types of courses	<p>The module's type of course is the lecture.</p> <ul style="list-style-type: none"> • L: Polymer Physics (2 LH) <p>The course will be held in German.</p>
Requirements for participation	none
Applicability of the module	for all scientific-technological master's programmes
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 30-minute oral exam about Polymer Physics
Credit points and grades	<p>3 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the summer semester of every other academic year.
Workload	The module comprises a student's total workload of 90 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Specialisation module

Module number	WPH4
Module title	Modern Microscopy (AFM)
Responsible for the module	Professorship of Solid Surfaces Analysis
Contents and qualification aims	<p><u>Contents:</u> The module Modern Microscopy conveys a comprehensive and logically connected presentation of the module's topic.</p> <p><u>Qualification aims:</u></p> <ul style="list-style-type: none"> • understanding of physical correlations • physical modelling • knowledge and understanding of characteristic approaches • ability for self-dependent work with scientific specialist literature
Types of courses	<p>The module's types of courses are lecture and seminar.</p> <ul style="list-style-type: none"> • L: Modern Microscopy (4 LH) • S: Modern Microscopy (2 LH) <p>The courses will be held in German.</p>
Requirements for participation	The module may only be taken if module 5517 Modern Microscopy has not been taken during the bachelor's programme Physics.
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 30-minute oral exam about the contents of the module Modern Microscopy
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will not be offered in every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over two semesters.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Specialisation module

Module number	WPH5
Module title	Theoretical Solid State Physics
Responsible for the module	Dean of Studies Physics (BA, MA) of the Faculty of Natural Sciences
Contents and qualification aims	<p><u>Contents:</u> The module Theoretical Solid State Physics conveys a comprehensive and logically connected presentation of the module's topic.</p> <p><u>Qualification aims:</u></p> <ul style="list-style-type: none"> • understanding of physical correlations • physical modelling • knowledge and understanding of characteristic approaches • ability for self-dependent work with scientific specialist literature
Types of courses	<p>The module's types of courses are lecture and seminar.</p> <ul style="list-style-type: none"> • L: Theoretical Solid State Physics I (2 LH) • S: Theoretical Solid State Physics I (1 LH) • L: Theoretical Solid State Physics II (2 LH) • S: Theoretical Solid State Physics II (1 LH) <p>The courses will be held in German.</p>
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 15-minute oral exam about the contents of the module
Credit points and grades	5 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.
Frequency of the module	The module will not be offered in every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over two semesters.

Specialisation module

Module number	WPH6
Module title	Experimental Physics – Complex Materials
Responsible for the module	Dean of Studies Physics (BA, MA) of the Faculty of Natural Sciences
Contents and qualification aims	<p><u>Contents:</u> Comprehensive and logically connected presentation of the basics of modern physics of complex materials. Based on experimental experience, physics of condensed matter will be broadened and applications concerning selected complex materials will be presented in an exemplary and comprehensible way from qualitative observation to quantitative measurements to generalised mathematical description.</p> <p><u>Qualification aims:</u></p> <ul style="list-style-type: none"> • understanding of basic physical correlations in complex materials • ability to choose methods for the preparation, analysis, description, and application of complex materials • ability for analytic, geometric, numeric abstraction and for modelling
Types of courses	<p>The module's types of courses are lecture and seminar.</p> <ul style="list-style-type: none"> • L: Experimental physics – Complex Materials (5 LH) • S: Experimental physics – Complex Materials (3 LH) • S: Solution of experimental-physical problems (2 LH) <p>The courses will be held in German.</p>
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • a 30-minute presentation during the seminar about the contents of the module
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 30-minute oral exam about the contents of the module
Credit points and grades	<p>10 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in every academic year.
Workload	The module comprises a student's total workload of 300 WH.
Duration of the module	Presuming a proper course of studies, the module extends over two semesters.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Specialisation module

Module number	WMB1
Module title	Surface and Interface Engineering
Responsible for the module	Professorship of Surface Engineering/Functional Materials
Contents and qualification aims	<p>Contents: The module's contents comprise surface- and coating technology and the formation of interfaces in hybrid composites, focussing on the understanding of process-structure-property-relations. Knowledge about all relevant processes for the production of metallic, inorganic-nonmetallic, and organic layers or surface structures will be conveyed. Strategies for a suitable formation of surfaces and interfaces are treated based on the complex profile of requirements regarding mechanical, tribological, corrosive, and thermal exposure.</p> <p>Qualification aims: The students learn about the processes for the treatment and coating of surfaces and interfaces, as well as the necessary pre- and post-treatment processes. They are enabled to choose processes and coating systems according to the application.</p>
Types of courses	<p>The module's types of courses are lecture, seminar, and practical course.</p> <ul style="list-style-type: none"> • L: Surface and Interface Engineering (2 LH) • S: Surface and Interface Engineering (1 LH) • P: Surface and Interface Engineering (1 LH)
Requirements for participation	Basics of chemical bonding, atomic structure, periodic table of the elements, structure of crystalline material, corrosion, and erosion
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points. The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • a 20-minute presentation during the seminar
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Surface and Interface Engineering
Credit points and grades	<p>5 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the summer semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Specialisation module

Module number	WET1
Module title	Materials in micro and nano technologies
Responsible for the module	Professorship of Materials for Nanoelectronics
Contents and qualification aims	<p>Contents:</p> <ul style="list-style-type: none"> • general methodologies of nano technology: classification and production • general methodologies of nano technology: characterisation • inorganic nanostructures based on semi-conductors • nanomagnetic materials • preparation and properties of inorganic materials • electronic and electro-optic molecular materials • self-organising nanostructured materials • macromolecules on interfaces and structured organic layers • bio-nanotechnology <p>Qualification aims: Understanding the basics and trends of modern methods and technologies of micro- and nanomaterials.</p>
Types of courses	<p>The module's types of courses are lecture and exercise.</p> <ul style="list-style-type: none"> • L: Materials in micro and nano technologies (2 LH) • E: Materials in micro and nano technologies (2 LH)
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • proof of exercises about Materials in micro and nano technologies Proof is provided if at least 50 percent of the exercises have been solved correctly.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 120-minute written exam about Materials in micro and nano technologies
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Specialisation module

Module number	WMB2
Module title	Printed Functionalities
Responsible for the module	Professorship of Digital Printing and Imaging Technology
Contents and qualification aims	<p>Contents: The course is devised as a basics-oriented introduction to the technologies of printing and coating of flexible polymer films and selected fiber-based substrates. Starting with workflow and the basic technologies for the preparation of traditional printing products (depicting text and images), specific further developments for future applications of printing beyond colour will be drafted and evolved.</p> <p>By means of exemplary printing applications in the areas of electronic circuits, RF communication, flexible energy sources, microsystems technology, smart objects, lightweight engineering, and packaging technology, printing and imaging technology will be incorporated into the students' engineering toolbox as one of the key technologies for the development of the industry of printed, flexible, organic and large area electronics.</p> <p>Qualification aims: The students get to know printing technology as a resource-friendly and therefore promising, additive manufacturing technology for applying liquid functional inks to flexible substrates in the electronics-, lightweight engineering-, and packaging industry.</p>
Types of courses	<p>The module's types of courses are lecture and practical course.</p> <ul style="list-style-type: none"> • L: Printed Functionalities (2 LH) • P: Printed Functionalities (1 LH)
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the exam and successfully passing the module exam are the requirements for earning credit points.</p> <p>The prerequisite for admission is the following pre-exam (may be repeated several times):</p> <ul style="list-style-type: none"> • successfully audited practical course Printed Functionalities (amount 30 WH)
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 180-minute written exam about Printed Functionalities
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Specialisation module

Module number	WMB3
Module title	Interface design for fibre-plastic composites
Responsible for the module	Professorship of Lightweight Structures / Polymer Technology
Contents and qualification aims	<p>Contents: The module conveys basic knowledge about design of the fibre/matrix interface which is crucial for quality and properties of the fibre-plastic composites. The students gain an overview of the physical and chemical properties of textile surfaces or matrix interfaces, of the possibilities for targeted activation, functionalisation, and modification of the outer material layer, and of material combinations and their compatibility. By means of examples, physical and chemical surface properties like surface energy and chemical structure will be experimentally determined.</p> <p>Qualification aims: In the module, the students will obtain basic knowledge from simple adhesion improvement up to the targeted interface design for fibre-plastic composites. The students are thus enabled to assess fibre/matrix adhesion and influence it specifically. Hence, the future graduates can be employed in production processes as well as in research and development.</p>
Types of courses	<p>The module's types of courses are lecture, seminar, and practical course.</p> <ul style="list-style-type: none"> • L: Interface design for fibre-plastic composites (2 LH) • S: Interface design for fibre-plastic composites (1 LH) • P: Interface design for fibre-plastic composites (1 LH) <p>The courses will be held in German.</p>
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 60-minute written exam about Interface design for fibre-plastic composites
Credit points and grades	<p>5 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the summer semester of every academic year.
Workload	The module comprises a student's total workload of 150 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WMB4
Module title	Electrochemical Coating
Responsible for the module	Professorship of Surface Engineering/Functional Materials
Contents and qualification aims	<p>Contents: In this module, relevant topics of wet-chemical coating processes are addressed and comprehensively conveyed. Contents are:</p> <ul style="list-style-type: none"> • Electrochemical basics • modelling of electrochemical processes • basics of the galvano technique • layer systems • coating technologies • electrochemical analytics • layer characterisation <p>Qualification aims: The module's contents follow the one-semester lecture Surface- and Coating Technologies and go into more depth concerning industrially relevant coating processes. Involving company representatives from the coating industry during the exercise course creates a highly practical relevance. The students learn about the most significant processes of pre- and post-treatment, as well as layer formation. They are thus enabled to choose layer systems considering the application and optimise processes.</p>
Types of courses	<p>The module's types of courses are lecture and exercise.</p> <ul style="list-style-type: none"> • L: Electrochemical Coating (1 LH) • E: Electrochemical Coating (1 LH) <p>The courses will be held in German.</p>
Requirements for participation	Basic knowledge of materials engineering, surface/coating technology
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	The module exam comprises: a 30-minute oral exam about Electrochemical Coating
Credit points and grades	3 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 90 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WMB5
Module title	Innovative Materials Engineering
Responsible for the module	Professorship of Composite Materials
Contents and qualification aims	<p>Contents: Multifaceted property profiles increasingly demand modern material composites and compounds including the rapid development of new manufacturing technologies, since a monolithic or single material cannot meet today's complex requirements anymore. Future material systems hold an economic key position and are of fundamental significance on growth markets. Tailor-made composites with adapted design are in demand. For this purpose, concepts for the ideal combination of components need to be developed. This asks for material-specific knowledge and the ability for correlation, as well as the organisation of complex technologies, not least with regard to continuous mass and line production (in-line, in-situ) and therefore to reducing the costs of to date expensive material composites and compounds.</p> <p>In the lecture, there will be a preliminary discussion of development and application of material composites and compounds and the relevance of these materials as tailor-made materials will be pointed out. The students will at first obtain an overview of the terminology. There will further be an introduction to production, properties, and application of reinforcing components in composite materials, like fibres, particles, CNTs, up to preforms. Materials engineering basics about particle and fibre reinforcement will be explained. Subsequently, the lecture will treat the properties and the application potential of polymer matrix, ceramic matrix, and metal matrix composites and material compounds (composite constructions, hybrid compounds).</p> <p>The goal is the transfer of knowledge about the production of material composites and compounds for significant material combinations. Much emphasis will be placed on the treatment of interfacial issues.</p> <p>Qualification aims: The module imparts the ability to handle the terminology of material composites and compounds. Furthermore, the students obtain knowledge to reliably evaluate properties and application potential of polymer matrix, ceramic matrix, and metal matrix composites, as well as composite constructions and hybrid compounds. The specific relevance of interface and structure-property correlation will be established. The students are equally able to assess and apply production processes and test procedures correctly regarding the possibilities and limitations of these materials.</p>
Types of courses	<p>The module's types of courses are lecture and practical course.</p> <ul style="list-style-type: none"> • L: Innovative Materials Engineering (2 LH) • P: Innovative Materials Engineering (1 LH)
Requirements for participation	Basics of materials engineering
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 120-minute written exam about Innovative Materials Engineering

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Credit points and grades	4 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.
Frequency of the module	The module will be offered in the summer semester of every academic year.
Workload	The module comprises a student's total workload of 120 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WMB6
Module title	Rheology of Polymers
Responsible for the module	Professorship of Lightweight Structures / Polymer Technology
Contents and qualification aims	<p>Contents: The lecture imparts basics about the rheological behaviour of thermoplastic and cross-linked polymers. To start with, rheological phenomena and physical parameters will be introduced. Building on that, the basic rheological bodies and the corresponding principles and flow rules will be treated. An integral part is the measuring of rheological parameters using rotational, vibrational, capillary, and extensional rheometers. These will first be introduced concerning their set-up and measuring principle and the basis of calculation needed for determining the parameters will be developed. It will be shown how the measured data are corrected and reasonably described for unknown flow rules. Finally, the material structure of polymers, emulsions, and suspensions will be addressed and their processing behaviour discussed.</p> <p>Qualification aims: Participants of this lecture will learn about the practical application of rheometry and the necessary rheological basics of polymers. They are then able to experimentally determine and apply the rheological parameters required for the processing of thermoplasts and thermosets. The students obtain methodological tools for analysing and controlling the flow and deformation behaviour of polymer melts in the application of measuring devices and plastics processing machines.</p>
Types of courses	<p>The module's type of course is the lecture.</p> <ul style="list-style-type: none"> • L: Rheology of Polymers (2 LH) <p>The course will be held in German.</p>
Requirements for participation	none
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Rheology of Polymers
Credit points and grades	<p>4 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the winter semester of every academic year.
Workload	The module comprises a student's total workload of 120 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Specialisation module

Module number	WMB7
Module title	Biomaterials and materials for medical technology
Responsible for the module	Professorship of Materials Engineering
Contents and qualification aims	<p>Contents: In this module, basics about materials with primary fields of application in medical technology – being of use as well in the human body as in apparatuses of medical technology – are systematically taught from a materials engineering point of view. Metallic materials, polymers, glasses and ceramics, composite materials, and foams are considered according to their technical relevance. The complex hierarchic structure and the special properties of biomaterials are compared with conventional materials.</p> <p>Qualification aims: The students obtain a comprehensive overview of the classes of materials applicable in medical technology, of surface aspects, and typical problematic practical areas like biocompatibility. They get to know test procedures and (structure) analysis methods. The students are enabled to choose materials for applications in medical technology and critically evaluate properties and fields of application.</p>
Types of courses	<p>The module's types of courses are lecture and exercise.</p> <ul style="list-style-type: none"> • L: Biomaterials and materials for medical technology (2 LH) • E: Biomaterials and materials for medical technology (1 LH) <p>The module will be offered as a block course. The courses will be held in German.</p>
Requirements for participation	Basics about chemical bonding, microstructure and material engineering, physics, chemistry
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 120-minute written exam about Biomaterials and materials for medical technology
Credit points and grades	<p>4 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the summer semester of every academic year.
Workload	The module comprises a student's total workload of 120 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Specialisation module

Module number	WMB8
Module title	Materials Engineering – Structure Formation Processes
Responsible for the module	Professorship of Materials Engineering
Contents and qualification aims	<p>Contents: The module Materials Engineering – Structure Formation Processes deals with the theoretical basics of processes in materials for engineering, which determine the formation of microstructures. Thermodynamic and kinetic processes that enable a theoretical understanding of phase diagrams, diffusion processes, and lattice defects in crystalline materials will be described. Furthermore, solidification of melts, precipitation processes, phase transitions, and reactions on inner and outer interfaces will be discussed. The outlines of the complex correlations between processing, structure, and the resulting properties will be shown. A detailed treatment of these contents will take place in the additionally eligible module Materials Engineering – Mechanical Properties.</p> <p>Qualification aims: The module enables the students to understand the complex processes of structure formation in simple model systems up to the materials technological production of modern engineering materials and to put them into context with relevant properties. Fundamental skills for the scientific and technological analysis of materials-related problems and for the optimisation of materials for engineering will be conveyed.</p>
Types of courses	<p>The module's type of course is the lecture.</p> <ul style="list-style-type: none"> • L: Materials Engineering – Structure Formation Processes (2 LH) <p>The course will be held in German.</p>
Requirements for participation	Basic knowledge about material technologies, technical physics, higher mathematics I and II
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <ul style="list-style-type: none"> • a 120-minute written exam about Materials Engineering – Structure Formation Processes
Credit points and grades	<p>3 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in the summer semester of every academic year.
Workload	The module comprises a student's total workload of 90 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Specialisation module

Module number	WS3
Module title	English in study-related and professional conversation I (Level B2)
Responsible for the module	Head of Department English at the Foreign Language Centre
Contents and qualification aims	<p>Contents: Extension of linguistic knowledge and skills regarding study- and profession-related issues and situations, imparting significant differences of oral and written communication (text types, appropriate register), composition of application documents;</p> <p>The training follows the language competence level C1 of the Common European Framework of Reference for Languages (CEFR) and contains a component of technical terminology.</p> <p>Qualification aims: Confidence in handling typical situations of academic everyday life (introducing persons and fields of work, naming and describing academic structures, etc.) and further development of reading and listening strategies;</p> <p>The completion of the module corresponds to the language competence level C1 of the Common European Framework of Reference for Languages (CEFR) with a focus on technical terminology.</p>
Types of courses	<p>The module's type of course is the exercise.</p> <ul style="list-style-type: none"> • E: Course 1 Study-related standard situations (4 LH)
Requirements for participation	<ul style="list-style-type: none"> • previous knowledge in English, generally A-level standard • placement test (recommendation of qualification)
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <p>Creditable course achievement:</p> <ul style="list-style-type: none"> • a 120-minute written exam about Course 1 <p>The exam needs to be graded with at least "sufficient" in order to be credit-ed.</p>
Credit points and grades	<p>4 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in every semester.
Workload	The module comprises a student's total workload of 120 WH. (60 hours of contact and 60 hours of self-study)
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WS4
Module title	English in study-related and professional conversation III (Level C1)
Responsible for the module	Head of Department English at the Foreign Language Centre
Contents and qualification aims	<p>Contents: Consolidation of technical terminology in selected areas and systematic extension of general vocabulary regarding study- and profession-related as well as intercultural issues, conduction of consultations and discussions, giving talks;</p> <p>The training follows the language competence level C1 of the Common European Framework of Reference for Languages (CEFR) and contains a component of technical terminology.</p> <p>Qualification aims: Confidence in the oral and written exchange of information and in the oral and written expression, confidence in presentations, acquisition of intercultural skills;</p> <p>The completion of the module corresponds to the language competence level C1 of the Common European Framework of Reference for Languages (CEFR) with a focus on technical terminology.</p>
Types of courses	<p>The module's type of course is the exercise.</p> <ul style="list-style-type: none"> • E: Course 3 Advanced English in job-related situations (4 LH)
Requirements for participation	<ul style="list-style-type: none"> • completed module English in study-related and professional conversation II (Level B2) or placement test (recommendation of qualification)
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises two parts. In detail, the following exams have to be taken:</p> <p>Creditable course achievements:</p> <ul style="list-style-type: none"> • a 120-minute written exam about Course 3 • a 30-minute oral exam (presentation) about Course 3 <p>The respective exams need to be graded with at least "sufficient" in order to be credited.</p>
Credit points and grades	<p>4 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p> <p>Creditable course achievements:</p> <ul style="list-style-type: none"> • Written exam about Course 3, weighting 4 (3 CP) • Oral exam about course 3, weighting 1 (1 CP)
Frequency of the module	The module will be offered in every semester.
Workload	The module comprises a student's total workload of 120 WH. (60 hours of contact and 60 hours of self-study).
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Specialisation module

Module number	WS5
Module title	German as a Foreign Language III (Level B1)
Responsible for the module	Head of Department German as a Foreign Language at the Foreign Language Centre
Contents and qualification aims	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • exercises for the extension of vocabulary and the improvement of speaking skills • communicative situations and assignments about topics like time and waste of time, free time, daily routine, studies, job and profession, modern media • repetition and consolidation of basic grammar and imparting of further grammatical structures, e.g. passive, subordinate clauses <p>The training follows the language competence level B1 of the Common European Framework of Reference for Languages (CEFR).</p> <p><u>Qualification aims:</u></p> <ul style="list-style-type: none"> • improvement of speaking skills, simple and coherent comments about familiar areas • relating experiences and incidences, describing goals and plans, stating reasons and giving explanations • communication by simple linguistic means • understanding and composing texts about everyday topics <p>The completion of the module corresponds to the language competence level B1 of the Common European Framework of Reference for Languages (CEFR).</p>
Types of courses	<p>The module's type of course is the exercise.</p> <ul style="list-style-type: none"> • E: Course 3 (4 LH)
Requirements for participation	Completed previous Course 2 or placement test (recommendation of qualification)
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <p>Creditable course achievement:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Course 3 <p>The exam needs to be graded with at least "sufficient" in order to be credited.</p>
Credit points and grades	<p>4 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in every semester.
Workload	The module comprises a student's total workload of 120 WH. (60 hours of contact and 60 hours of self-study).

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Duration of the module	Presuming a proper course of studies, the module extends over one semester.
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Specialisation module

Module number	WS6
Module title	German as a Foreign Language IV (Level B2)
Responsible for the module	Head of Department German as a Foreign Language at the Foreign Language Centre
Contents and qualification aims	<p><u>Contents:</u></p> <ul style="list-style-type: none"> practising all language skills, like listening, speaking, reading, writing, by means of numerous general-language topics, e.g. travel, holiday, living abroad, education, intercultural relations, as well as study- and profession-related issues and situations consolidation and extension of grammatical structures with the help of exercises about nominal structures and subordinate clauses, passive constructions, present subjunctive and past subjunctive composition of application documents <p>The training follows the language competence level B2 of the Common European Framework of Reference for Languages (CEFR).</p> <p><u>Qualification aims:</u></p> <ul style="list-style-type: none"> understanding the main content of complex texts about concrete and abstract topics spontaneous and fluent communication precise and detailed comments over a broad spectrum of topics defining one's position on current issues <p>The completion of the module corresponds to the language competence level B2 of the Common European Framework of Reference for Languages (CEFR).</p>
Types of courses	<p>The module's type of course is the exercise.</p> <ul style="list-style-type: none"> E: Course 4 (4 LH)
Requirements for participation	Completed previous Course 3 or placement test (recommendation of qualification)
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <p>Creditable course achievement:</p> <ul style="list-style-type: none"> a 90-minute written exam about Course 4 <p>The exam needs to be graded with at least "sufficient" in order to be credited.</p>
Credit points and grades	<p>4 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will be offered in every semester.
Workload	The module comprises a student's total workload of 120 WH. (60 hours of contact and 60 hours of self-study).

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Duration of the module	Presuming a proper course of studies, the module extends over one semester.
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Specialisation module

Module number	WS7
Module title	German as a Foreign Language – Specialised Communication I (Level C1)
Responsible for the module	Head of Department German as a Foreign Language at the Foreign Language Centre
Contents and qualification aims	<p>Contents:</p> <ul style="list-style-type: none"> • focus on conveying models of word formation and on extending and consolidating technical terminology in the context of selected interdisciplinary topics • Overview of the morphology of the target language concerning study- and profession-related situations <p>The training follows the language competence level C1 of the Common European Framework of Reference for Languages (CEFR) and contains a component of technical terminology.</p> <p>Qualification aims:</p> <ul style="list-style-type: none"> • coping linguistically with study- and profession-related situations • confidence in the oral and written use of technical terminology • ability to analyse and interpret country- and culture-specific circumstances <p>The completion of the module corresponds to the language competence level C1 of the Common European Framework of Reference for Languages (CEFR) with a focus on technical terminology.</p>
Types of courses	<p>The module's type of course is the exercise.</p> <ul style="list-style-type: none"> • E: Specialised Communication I (4 LH) •
Requirements for participation	Proof of level B2 of the Common European Framework of Reference for Languages (CEFR) or placement test (recommendation of qualification)
Applicability of the module	---
Requirements for credit points to be awarded	Successfully passing the module exam is the requirement for earning credit points.
Module exam	<p>The module exam comprises:</p> <p>Creditable course achievement:</p> <ul style="list-style-type: none"> • a 90-minute written exam about Specialised Communication I <p>The exam needs to be graded with at least "sufficient" in order to be credit-ed.</p>
Credit points and grades	<p>4 credit points are awarded for the module.</p> <p>Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations.</p>
Frequency of the module	The module will in general be offered in every semester.
Workload	The module comprises a student's total workload of 120 WH. (60 hours of contact and 60 hours of self-study).
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Module Master's Thesis

Module number	AFM3
Module title	Master's Thesis
Responsible for the module	Dean of Studies Advanced Functional Materials of the Faculty of Natural Sciences
Contents and qualification aims	<p><u>Contents:</u></p> <ul style="list-style-type: none"> • self-dependent work on a given topic from the area of "Advanced Functional Materials" • developing a strategic concept for organising a scientific project • literature research • critical discussion of experimental results • composition of a scientific report in written form (master's thesis) <p><u>Qualification aims:</u> The students learn to work self-dependently on a scientific topic taking into account the current state-of-the-art, to complete a scientific task in their area of specialisation within a given time, to develop and realise ideas of their own. They are enabled to communicate, discuss, and publish the obtained results in accordance with scientific conventions.</p>
Types of courses	The module's type of course is the project. <ul style="list-style-type: none"> • PR: (30 LH)
Requirements for participation	80 credit points from the curriculum of the master's degree programme Advanced Functional Materials must have been earned. There will be safety instructions / an introduction course according to the Ordinance on Hazardous Substances prior to laboratory work. Attendance is obligatory.
Applicability of the module	---
Requirements for credit points to be awarded	<p>Meeting the prerequisite for admission to the single exams and successfully passing the module exams are the requirements for earning credit points.</p> <p>The prerequisite for admission is:</p> <ul style="list-style-type: none"> • 80 credit points from the curriculum of the master's degree programme Advanced Functional Materials must have been earned

Appendix 2: Module descriptions for the consecutive degree programme Advanced Functional Materials in English language leading to the Master of Science (M.Sc.)

Module exam	The module exam comprises two parts. In detail, the following exams have to be taken: <ul style="list-style-type: none">• master's thesis (approx. 80 pages long, duration 23 weeks)• a 20-minute presentation of the master's thesis with subsequent scientific discussion (colloquium)
Credit points and grades	30 credit points are awarded for the module. Evaluation of the exam and formation of the module grade are laid down in Section 10 of the examination regulations. Examinations: <ul style="list-style-type: none">• master's thesis, weighting 3 - passing required• presentation of the master's thesis with subsequent scientific discussion (colloquium), weighting 1 - passing required
Frequency of the module	The module will be offered in every semester.
Workload	The module comprises a student's total workload of 900 WH.
Duration of the module	Presuming a proper course of studies, the module extends over one semester.

**Examination regulations for the consecutive degree programme
Advanced Functional Materials
in English language leading to the Master of Science (M.Sc.)
at the Technische Universität Chemnitz
dated ...**

Based on Sect. 13(4) in conjunction with Sect. 34(1) of the Law on the Autonomy of Institutions of Higher Education in the Free State of Saxony (Sächsisches Hochschulfreiheitsgesetz - SächsHSFG) as promulgated on January 15, 2013 (SächsGVBl. p. 3), last amended by Article 11 of the law of April 29, 2015 (SächsGVBl. p. 349, 354), the faculty board of the Faculty of Natural Sciences at the Technische Universität Chemnitz enacts the following examination regulations:

Table of contents

Part 1: General provisions

Section 1	Standard period of study
Section 2	Organisation of examinations
Section 3	Time limits
Section 4	Admission procedure, disclosure of examination dates and results
Section 5	Types of examinations
Section 6	Oral examinations
Section 7	Written examinations and other pieces of work in writing
Section 8	Alternative examinations
Section 9	Project work
Section 10	Evaluation of examinations, formation and weighting of grades
Section 11	Absence, withdrawal, deceit, breach of regulations
Section 12	(n/a)
Section 13	Passing and failing of examinations
Section 14	Repetition of module examinations
Section 15	Accreditation of study periods, course and examination achievements
Section 16	Examining board
Section 17	Examiner and observer
Section 18	Purpose of the master's examination
Section 19	Allocation of topic, submission, evaluation, and repetition of the master's thesis
Section 20	Master's degree certificate and document
Section 21	Invalidity of the master's examination
Section 22	Inspection of examination files
Section 23	Responsibilities

Part 2: Subject-specific provisions

Section 24	Organisation and scope of the study programme
Section 25	Subject, type and scope of the master's examination
Section 26	Time limit of the master's thesis, colloquium
Section 27	Academic degree

Part 3: Final provisions

Section 28	Effective date and publication
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In these examination regulations, grammatically masculine designations of persons equally apply to female and masculine persons. Women may use the the titles of offices and functions in these examination regulations in grammatically feminine form. This applies accordingly to the awarding of university degrees, academic positions and titles.

Part 1 **General provisions**

Section 1 **Standard period of study**

The programme's standard period of study are four semesters (two years). The standard period of study comprises the study programme and all module examinations including the module Master's Thesis.

Section 2 **Organisation of examinations**

The master's examination consists of module examinations. Module examinations generally comprise up to two single examinations. The module examinations will be taken alongside the study programme.

Section 3 **Time limits**

- (1) The master's examination is to be taken within the standard period of study.
- (2) The range of courses offered ensures that all pre-examinations and module examinations may be taken within the periods intended in the study regulations (examinations generally following the lecture period).

Section 4 **Admission procedure, disclosure of examination dates and results**

- (1) The master's examination can only be taken by a student who
 1. is enrolled in the master's degree programme Advanced Functional Materials at the Technische Universität Chemnitz and
 2. has not ultimately failed the master's examination in the same programme and
 3. has taken the pre-examinations stated in detail in the module descriptions for the respective examinations.
- (2) Application for admission to the master's examination is to be handed in at the examination office in written form for each single examination at the latest three weeks before the start of the central period of examinations at the Technische Universität Chemnitz, or, in the case of examinations outside the central period of examinations, at the latest three weeks before the examination date. The application has to be accompanied by:
 1. an indication of the module the examination relates to,
 2. proof of the admission requirements stated in para. 1
 3. the candidate's declaration of being familiar with the examination regulations and whether a master's examination in the same programme has already been failed or ultimately failed or whether a pending examination procedure is under way.
- (3) The examining board decides about the admission, in urgent cases their chairperson.
- (4) Persons who have acquired the knowledge and skills required by study and examination regulations, may, in deviation from para. 1 sentence 1, obtain the qualifying degree in an academic examination as an external. The examining board decides about the application for admission to the master's examination, as well as about the examination procedure and the examinations to be taken, which have to be in accordance with the examination regulations.
- (5) The admission to an examination of the master's examination may only be refused if
 1. the requirements stated in para. 1 or the procedure rules according to para. 2 have not been fulfilled,
 2. the documents to be submitted as per para. 2 are incomplete,
 3. the candidate has ultimately failed the master's examination in the same programme or
 4. the candidate has lost the examination claim under state law by exceeding the time limit for application to the respective examination or for taking it.
- (6) The candidate has to be notified of negative decisions in written form at the latest two weeks before the start of the examination, including an indication of reasons and an instruction on the right to appeal.
- (7) In time, the candidate will be informed of type, number, subject, and organisation of the module examinations to be taken as well as of their dates, and equally of the allocation and submission dates of assignments and the master's thesis. The disclosure of examination dates, admission lists, and examination results will take place at the examination office. The failing of examinations will additionally be notified to the candidate in written form.

Section 5 **Types of examinations**

(1) examinations are to be taken as

1. oral examinations (Section 6) and/or
2. written examinations or other pieces of work in writing (Section 7) and/or
3. alternative examinations (Section 8) and/or
4. project work (Section 9).

(2) If a candidate furnishes evidence by medical certificate, that due to chronic illness or handicap he is not able to take examinations in whole or in part in the intended form, the examining board should allow the candidate upon application to take equivalent examinations in a different form.

(3) The examination language is English. In cases of courses held in German according to the module descriptions, the examination language will also be German. Upon the candidate's application, examinations may also be taken in German or English. The application does not substantiate a claim.

Section 6 **Oral examinations**

(1) In oral examinations, the candidate has to prove the ability to recognise correlations in the area of the examination and to integrate specific problems into these contexts. It shall further be determined whether the candidate possesses the appropriate knowledge for his current state of studies.

(2) Oral examinations are to be held by several examiners or by one examiner in the presence of an expert observer.

(3) Oral examinations may be taken as group or individual examinations. The duration of the examination has to be at least 15 minutes and at the most 45 minutes for each single candidate.

(4) During oral examinations, tasks to be handled in written form may also be assigned to an adequate extent, as long as the oral character of the examination is maintained.

(5) The essential topics, the duration, progression, and grade of the oral examination are to be taken down in a protocol, which has to be signed by the examiners, or, in the case of an observer, by the examiner and the observer. Result and grade are to be disclosed to the candidate following the respective oral examination. The protocol is to be enclosed in the examination file.

(6) Students intending to take the same examination at a later examination date may be admitted as listeners by the examiner(s), space permitting, unless the candidate objects. The admission does not include the conferring about the examination result and its disclosure.

(7) The examination may be intermittent for important reasons. A new examination date is to be set for the examination to be held as soon as the reason for intermission has become void. The reasons leading to the intermission have to be noted down in the examination protocol.

Section 7 **Written examinations and other pieces of work in writing**

(1) Examinations in written form comprise written examinations and other pieces of work in writing in which the candidate proves his ability to solve problems and work on topics within limited time based on the necessary basic knowledge and with established methods of his subject. For examinations in written form, a selection of topics and tasks may be provided for the candidate to choose from.

(2) The multiple-choice procedure ranks among the other pieces of work in writing. The questions for the multiple-choice procedure generally have to be formulated by two examiners who also have to determine the evaluation scale. The assessment of multiple-choice procedures may be carried out automatically.

(3) When the passing of examinations in written form is a prerequisite for continuing the study programme, they are generally evaluated by two examiners. The evaluation process shall not exceed four weeks.

(4) The duration of examinations in written form must not be less than 60 minutes and not exceed the maximum of 300 minutes.

(5) The examiner decides about resources permitted to be used during an examination in written form. The permitted resources are to be disclosed in time.

(6) In justified exceptional cases, the examining board may decide to replace the intended examination in written form by an oral examination in the following examination period. The intended duration of the examination is to be defined. The decision of the examining board has to be disclosed at the beginning of the respective semester.

Section 8

Alternative examinations

(1) Alternative examinations will particularly be held in the context of seminars, practical courses, or exercises. The achievement will notably be effected in form of written reports, assignments, presentations, or protocols of practical work during one or more courses. The achievements have to be individually allocatable. In the case of assignments and in general in written reports, the candidate has to declare that he has completed the work self-dependently and without the use of any but the specified sources and means.

(2) Concerning the evaluation of alternative examinations, Section 6(2) and (5) and Section 7(3) apply accordingly.

(3) Duration and scope of alternative examinations are defined in the module descriptions.

Section 9

Project work

(1) By means of project work, possible as individual or group work, teamwork skills and specifically the capability for development, realisation, and presentation of concepts may in general be established. The achievements have to be individually allocatable. The candidate should thus prove his ability to define goals in a more extensive task and to develop interdisciplinary solution approaches and concepts. A project work generally comprises the oral presentation and a written evaluation or documentation of the results.

(2) When the passing of a project work is a prerequisite for continuing the study programme, Section 6(2) and (5) and Section 7(3) apply accordingly.

(3) The duration of the oral presentation and the scope of the written report are defined in the module descriptions.

Section 10

Evaluation of examinations, formation and weighting of grades

(1) The grades for individual examination achievements are determined by the respective examiners. The following grades are to be used for the evaluation of examinations:

1 - very good	(an outstanding achievement)
2 - good	(an achievement significantly above the average requirements)
3 - satisfactory	(an achievement meeting the average requirements)
4 - sufficient	(an achievement only just meeting the requirements despite deficiencies)
5 - insufficient	(an achievement not meeting the requirements due to significant deficiencies).

For a more differentiated evaluation of examination achievements, individual grades may be raised or lowered to interim values by 0.3, excluding the grades 0.7, 4.3, 4.7, and 5.3. For examinations evaluated by two or more examiners, the grade of the examination achievement is the arithmetic average of the individual evaluations. Para. 2 sentence 2 applies accordingly to the formation of the arithmetic average. The grade of the examination achievement calculated by forming the arithmetic average may be rounded up or off by the examiners to result in a feasible grade according to sentences 2 and 3. Should the result be a grade of higher than 4.0, the examination will be evaluated as "insufficient".

(2) In the case of module examinations comprising several individual examinations, the module grade is calculated according to the module description as the weighted arithmetic average of the individual examination grades, otherwise the examination grade equals the module grade. Only the first decimal after the decimal point without rounding is considered. All further decimals are deleted. The module grades correspond to the following rating:

at an average up to and including 1.5	- very good,
at an average of 1.6 up to and including 2.5	- good,
at an average of 2.6 up to and including 3.5	- satisfactory,
at an average of 3.6 up to and including 4.0	- sufficient,
at an average from 4.1	- insufficient.

(3) In order to pass the module Master's Thesis, the master's thesis needs to be evaluated at least with the grade "sufficient" by both examiners. The grade for the master's thesis is calculated from the arithmetic average of both examiners' grades.

(4) An overall grade is formed for the master's examination. The overall grade is calculated from the weighted arithmetic average of the module grades including the grade for the module Master's Thesis (see Section 25). Para. 2 sentences 2 and 3 apply accordingly to the formation of the overall grade.

(5) Course achievements have to comply with examination achievements in nature and extent in order to be accredited as examination achievements. The master's examination cannot predominantly be effected by accreditation of course achievements. The examining board decides about the accreditation.

Section 11

Absence, withdrawal, deceit, breach of regulations

(1) The candidate may withdraw the application for an examination without giving reasons, as long as the examination office is notified at the latest one week before the respective examination date.

(2) An examination is considered as evaluated "insufficient" (5.0), if the candidate is absent from a binding examination date without good reason, or if he withdraws without good reason from an examination he has lined up for. The same applies if an examination in written form is not effected within the given time period.

(3) The reasons claimed for withdrawal or absence have to be immediately and creditably notified in writing to the examining board. In the case of a candidate's illness, providing a medical certificate and in cases of doubt an official medical certificate may be demanded. Concerning compliance with deadlines for the first-time application to an examination, repetition of examinations, reasons for the absence from examinations, and compliance with time limits for the completion of examination papers, a candidate's illness equals the illness of a child for whom the candidate is the predominantly sole carer.

(4) If the examining board acknowledges the reasons according to para. 3, a new examination date will be scheduled together with the candidate.

(5) If the candidate tries to influence the outcome of his examination by deceit or use of non-permitted resources, the respective examination will be evaluated as "insufficient" (5.0).

(6) A candidate who disrupts the proper course of the examination may be excluded from continuing the examination by the respective examiner or supervisor; in this case, the examination will be evaluated as "insufficient" (5.0).

(7) Within two weeks from decisions made according to para. 5 or 6, the candidate may have those decisions reviewed by the examining board.

Section 12

(n/a)

Section 13

Passing and failing of examinations

(1) Module examinations need to be graded at least as "sufficient" (4.0) in order to be passed. If examinations which are marked with "passing required" in the module descriptions are evaluated as "insufficient", the module examination is considered as failed. Failed module examinations that are not repeated within one year (Section 14(1)) or that are evaluated as "insufficient" at the repetition, result in a failed module examination. If the application for a second repetition of the module examination (Section 14(2)) has not been made in time, if the application could not be approved, if a second repetition examination has not been taken at the next possible examination date, or if this examination has been evaluated as "insufficient", the module examination is considered as "ultimately failed".

(2) By ultimately failing a module examination, the master's examination is considered as "ultimately failed".

(3) The master's examination is passed, when the required pre-exams have been taken and all module examinations have been passed. A master's examination that has not been completed within four semesters after the standard period of study is considered as "failed".

(4) If an examination procedure is proven to have been defective, thus influencing the examination achievement, there may be an order upon a candidate's application or ex officio to schedule the examination or individual parts of it anew for a specific candidate or all candidates. In this case, the examination results already obtained are invalid.

(5) Deficiencies in the examination procedure have to be claimed immediately, at the latest within one month after the respective examination day, at the chairperson of the examining board or the examiner. Orders according to para. 4 can only be effected up to a point in time when an application for the following examination period is still possible.

Section 14

Repetition of module examinations

(1) A repetition examination is possible in the case of failing a module examination (module grade "insufficient"). If the module examination comprises more than one individual examination, only those examinations evaluated as "insufficient" that are required for passing the module examination may be repeated. Irrespective of this, examinations marked with "passing required" in the module descriptions and having been evaluated as "insufficient" have to be repeated. A repetition examination is only permissible within one year. This period of time begins with the disclosure of the examination result of the module examination. After the end of this period of time, the module examination is considered as "failed".

(2) The admission to a second repetition examination is only possible upon application at the next possible examination date. Further repetition examinations are not permissible.

(3) The repetition of a passed examination is not permissible.

Section 15

Accreditation of study periods, course and examination achievements

(1) Study periods, course achievements and examination achievements from other study programmes are accredited upon the student's application, unless there are significant differences concerning the acquired skills. Instead of a schematic comparison, an overall survey and overall evaluation is to be carried out. The accreditation may be refused if more than 80 credit points or the master's thesis are to be accredited. The examining board decides about the accreditation. Concerning accreditation of study periods, course and examination achievements acquired outside the Federal Republic of Germany, the agreements on equivalence as approved by the Conference of the Ministers of Education and Cultural Affairs (Kultusministerkonferenz, KMK) and the German Rectors' Conference (Hochschulrektorenkonferenz, HRK) as well as understandings relating to university cooperation agreements are to be taken into account.

(2) Relevant work experience may be accredited by the examining board upon the student's application.

(3) University applicants with university entrance qualification are placed in a higher semester, if they can provide evidence of the necessary skills and knowledge by means of a special academic test (placement test).

(4) If course and examination achievements are accredited, the credit points and grades are to be carried over – as far as the grading systems are comparable. In the case of incomparable grading systems, the notation "passed" will be laid down.

(5) The students have to provide the necessary documents for the accreditation of study periods, course and examination achievements.

Section 16

Examining board

(1) The faculty board of the Faculty of Natural Sciences appoints an examining board for the organisation of the examinations and for the administration of the tasks assigned by these examination regulations.

(2) The examining board comprises the chairperson, their deputy, and two further members from the ranks of the professors at the Faculty of Natural Sciences, two members from the ranks of the scientific associates at the Faculty of Natural Sciences, and one member from the ranks of students.

(3) In general, the duration of the term of office is three years, for student members one year.

(4) The examining board is responsible for all matters in connection with the examination regulations, particularly for:

1. the organisation of examinations,
2. the accreditation of study periods and course and examination achievements,
3. the appointment of examiners and observers,
4. the decision about appropriate examination conditions for students during maternity and parental leave,
5. the decision about appropriate examination conditions for disabled students and chronically ill persons.

(5) The examining board may delegate the chairperson to carry out tasks. This does not apply to decisions according to Section 11 and Section 13(4), to decisions about appeals, and to reports to the faculty board.

(6) The examining board reports to the faculty board about the development of examination and study periods, the actual time periods needed for completing the master's thesis, about the distribution of

module and overall grades, and it makes suggestions as to reforming the study and examination regulations.

(7) The examining board has a quorum when the chairperson or their deputy and the majority of the members are present and the professors command the majority of votes. The meetings of the examining board are closed to the public.

(8) The members of the examining board have the right to attend when examinations are being held. They cannot administer examining board responsibilities while they themselves are involved in an examination.

(9) The members of the examining board are subject to official secrecy. They are bound to secrecy about the topics of examining board meetings.

(10) For all matters concerning the examination regulations, the examining board is the effecting and reviewing authority. Detrimental decisions have to be immediately disclosed and justified to the candidate in written form, including an instruction on the right to appeal.

Section 17 Examiner and observer

(1) The examining board appoints the examiners and observers. The appointment of examiners shall occur from the ranks of members and affiliates of the university or other institutions of higher education, who are authorised to lecture independently in the respective examination subject. If appropriate relating to the object of the examination, the examiner may also be appointed from the ranks of those who are only authorised to lecture independently in a section of the examination subject. In specific exceptional cases, qualified teachers for specific tasks as well as persons experienced in professional practice and training may be appointed as examiners, if appropriate relating to the character of the examination. Examination achievements may only be evaluated by persons possessing themselves at least the same or equivalent qualification to be asserted by the examination.

(2) The candidate may suggest the examiner or a group of examiners to the examining board for the evaluation of his master's thesis (Section 19) and of oral examinations (Section 6). The suggestion does not substantiate a claim.

(3) The examining board takes care to disclose the names of the examiners to the candidate at least two weeks before the examination date.

(4) Section 16(9) applies to the examiners and observers accordingly.

Section 18 Purpose of the master's examination

The master's examination constitutes the degree with professional qualification of the master's programme. By means of the master's examination, it shall be determined:

- whether the candidate proves to possess a knowledge and understanding which usually builds upon the bachelor level and is significantly deepened and extended,
- whether the candidate is able to define and interpret the characteristics, limits, terminology, and schools of thought of the subject area,
- whether the candidate is able to apply his knowledge and understanding to problem solving in new and unfamiliar situations as well, and
- whether the candidate is capable of coming to scientifically informed decisions based on incomplete and limited information while taking into account social, scientific, and ethical aspects.

Section 19

Allocation of topic, submission, evaluation, and repetition of the master's thesis

(1) In the master's thesis, the candidate is to show his ability to work self-dependently on a suitable subject-specific or interdisciplinary task at the current state-of-the-art in research or application within the given time limit, using scientific methods and expressing and imparting his results in a clear and unambiguous way.

(2) The topic of the master's thesis must be in context with the study programme. The master's thesis can be supervised by every authorised examiner. The candidate has the right to suggest a supervisor and a topic. There is no legal claim for the suggestion to be complied with.

(3) When submitting the master's thesis, the candidate has to declare that he has completed the work self-dependently and without the use of any but the specified sources and means. In the case of teamwork, the individual contribution of each candidate is to be identified in detail.

(4) The master's thesis has to be handed in on time at the central examination office in two typed and bound copies, supplemented by a digital file of the thesis in a version suitable for permanent reproduction of the written characters.

(5) The allocation of a topic and the date of submission are to be put on record.

- (6) The topic of the master's thesis may be replaced once, but only within four weeks after allocation of the topic. A further replacement of the topic is excluded.
- (7) Generally, the master's thesis has to be evaluated by at least two examiners. The supervisor of the master's thesis should be among these. The evaluation is carried out according to Section 10(1) and (3) of these examination regulations. The evaluation process should not exceed four weeks.
- (8) Master's theses not submitted on time are evaluated with the grade "insufficient" (5.0). If a master's thesis is evaluated worse than "sufficient" (4.0), it may only be repeated once. In the case of a repetition of the master's thesis, a replacement of the topic within the time limit stated in para. 6 is only permissible, if the candidate has not already exercised this option for writing his master's thesis evaluated as "insufficient".

Section 20

Master's degree certificate and document

- (1) After the successful completion of the master's examination, a certificate will immediately be issued, preferably within four weeks. The module names, module grades, as well as the awarded credit points, the topic of the master's thesis, the overall grade and sum total of credit points are to be included in the master's degree certificate.
- (2) The certificate bears the date of the last examination taken and will be signed by the chairperson of the examining board. Together with the master's degree certificate, the candidate will receive the master's degree document bearing the certificate date. This authenticates the awarding of the master's degree. The master's degree document will be signed by the dean and the chairperson of the examining board and will hold the seal of the Technische Universität Chemnitz. An English translation of the master's degree document has to be enclosed.
- (3) A diploma supplement will be issued. To describe the national educational system, the text agreed between the Conference of the Ministers of Education and Cultural Affairs (Kultusministerkonferenz, KMK) and the German Rectors' Conference (Hochschulrektorenkonferenz, HRK) is to be used in the applicable version.
- (4) Sorbs may additionally hold the degree in Sorbian language and upon request receive a Sorbian version of master's degree certificate and document.
- (5) Upon application, the examination office will issue a study certificate stating the accomplished achievements for students who do not complete their study programme.

Section 21

Invalidity of the master's examination

- (1) If the fact of a candidate's deceit in an examination emerges only after the handing over of the certificate, the grade of the examination may be corrected according to Section 11(5). Where required, the module examination may be declared as "insufficient" and the master's examination as "failed".
- (2) If, without the candidate's planning for deceit, the requirements for admission to an examination were not fulfilled and the fact emerges only after the handing over of the certificate, this deficiency will be cured by passing the examination. Should the candidate wilfully and wrongly have effected the admission, the module examination may be declared as "insufficient" and the master's examination as "failed".
- (3) The incorrect certificate is to be withdrawn and, if applicable, a new one to be issued. Together with the incorrect certificate, the master's degree document, its English translation, and the diploma supplement are to be withdrawn, if the master's examination has been declared as "failed" due to deceit. A decision according to para. 1 and para. 2 sentence 2 is excluded following a time period of five years from the certificate's issue date.
- (4) The candidate has to be given the opportunity to make a statement prior to a decision according to para. 1 or para. 2.

Section 22

Inspection of examination files

Upon application within one year from the completion of the examination procedure, the graduate may be granted inspection of his written examinations, of the respective assessments and of the examination protocols within a reasonable period of time.

Section 23 Responsibilities

Particularly decisions concerning the consequences of breaches of the examination regulations (Section 11), passing and failing (Section 13), the accreditation of examination and study achievements (Section 15), the appointment of examiners and observers (Section 17), the right to allocation of master's theses (Section 19), and the invalidity of the master's examination (Section 21) are made by the examining board. The issue of certificates and documents falls to the examination office.

Part 2 Subject-specific provisions

Section 24 Organisation and scope of the study programme

- (1) The study programme has a modular structure. It comprises basic and specialisation modules which are offered as compulsory or elective modules, and the module Master's Thesis.
- (2) For successfully completing the master's degree programme, 120 credit points are required.
- (3) The time frame of the student's required workload is approximately 900 working hours per semester. The respective intended credit points are awarded upon successfully completing module examinations.
- (4) Prior to completing the last examination, the students may take examinations in more elective modules of the programme than needed for providing 30 CP. Those additionally chosen elective modules are to be registered by the students as additional modules. The examination results of these additional modules will upon the students' application be included in the certificate, but not taken into account for the determination of the overall grade.

Section 25 Subject, type and scope of the master's examination

- (1) The following modules are integral parts of the master's examination:

1. Basic modules:

CH1 - Synthetic Methods in Chemistry	5 CP (compulsory module), weighting 5
CH2 - Analytical Methods	5 CP (compulsory module), weighting 5
CH3 - Sustainable Production Technologies	5 CP (compulsory module), weighting 5
PH1 - Advanced Surfaces, Thin Films and Interfaces	5 CP (compulsory module), weighting 5
PH2 - Semiconductor physics - Nano structures	5 CP (compulsory module), weighting 5
PH3 - Photovoltaics with Nanotechnology	5 CP (compulsory module), weighting 5
AFM1 - Facets of Materials Science	10 CP (compulsory module), weighting 10

2. Specialisation modules:

AFM2 - Research Project	20 CP (compulsory module), weighting 20
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From the following, modules amounting to a sum of 30 CP have to be chosen. To broaden the selection range, up to 32 CP may be chosen. Those additional credit points will not be counted as credits towards the degree. Upon application and on an individual basis, the examining board can authorise the choice of other suitable modules.

Students whose first language is not German and who can't show proof the level A1 of the Common European Framework of Reference for Languages, are obligated to take the following module:

WS1 – German as a Foreign Language I (Level A1)	4 CP (elective module), weighting 4
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Students whose first language is not German and who can't show proof the level A2 of the Common European Framework of Reference for Languages, are obligated to take the following module:

WS2 – German as a Foreign Language II (Level A2)	4 CP (elective module), weighting 4
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WCH1 - Colloids	5 CP (elective module), weighting 5
WCH2 - Polymer Materials	5 CP (elective module), weighting 5
WCH3 - Materials Technology	3 CP (elective module), weighting 3
WCH4 - Processes and products of the chemical industry	5 CP (elective module), weighting 5
WCH5 - Practice of electrochemical materials science	5 CP (elective module), weighting 5
WCH6 - Functional Materials	5 CP (elective module), weighting 5
WCH7 - Analytics of surfaces and colloids	3 CP (elective module), weighting 3

WCH8 - Practical course for analytics of surfaces and colloids	3 CP (elective module), weighting 3
WCH9 - Spectroelectrochemistry	3 CP (elective module), weighting 3
WCH10 - Surface Spectroscopies	3 CP (elective module), weighting 3
WCH11 - Heterogeneous Catalysis	5 CP (elective module), weighting 5
WCH12 - Challenges for future energy concepts - Chemical energy conversion	5 CP (elective module), weighting 5
WCH13 - Crystallography	5 CP (elective module), weighting 5
WCH14 - The Energiewende	5 CP (elective module), weighting 5
WPH1 - Nanophysics - Physics of mesoscopic systems	5 CP (elective module), weighting 5
WPH2 - Microscopy and analysis on the nano scale	5 CP (elective module), weighting 5
WPH3 – Polymer Physics	3 CP (elective module), weighting 3
WPH4 - Modern Microscopy (AFM)	5 CP (elective module), weighting 5
WPH5 - Theoretical Solid State Physics	5 CP (elective module), weighting 5
WPH6 - Experimental Physics – Complex Materials	10 CP (elective module), weighting 10
WMB1 - Surface and Interface Engineering	5 CP (elective module), weighting 5
WET1 - Materials in micro and nano technologies	5 CP (elective module), weighting 5
WMB2 - Printed Functionalities	5 CP (elective module), weighting 5
WMB3 - Interface design for fibre-plastic composites	5 CP (elective module), weighting 5
WMB4 - Electrochemical Coating	3 CP (elective module), weighting 3
WMB5 - Innovative Materials Engineering	4 CP (elective module), weighting 4
WMB6 - Rheology of Polymers	4 CP (elective module), weighting 4
WMB7 - Biomaterials and materials for medical technology	4 CP (elective module), weighting 4
WMB8 - Materials Engineering – Structure Formation Processes	3 CP (elective module), weighting 3

Option only for students whose first language is not English and who haven't yet taken one of the modules German as a Foreign Language I (Level A1) or German as a Foreign Language II (Level A2). One of the following modules may be chosen:

WS3 - English in study-related and professional conversation I (Level B2)	4 CP (elective module), weighting 4
WS4 - English in study-related and professional conversation III (Level C1)	4 CP (elective module), weighting 4

Option only for students whose first language is not German and who haven't yet taken one of the modules German as a Foreign Language I (Level A1) or German as a Foreign Language II (Level A2). One of the following modules may be chosen:

WS5 - German as a Foreign Language III (Level B1)	4 CP (elective module), weighting 4
WS6 - German as a Foreign Language IV (Level B2)	4 CP (elective module), weighting 4
WS7 - German as a Foreign Language – Specialised Communication I (Level C1)	4 CP (elective module), weighting 4

3. Module Master's Thesis:

AFM3 – Master's Thesis	30 CP (compulsory module), weighting 30
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(2) Number, type, subject, and organisation of the examinations and pre-examinations are determined in the module descriptions, which are part of the study regulations.

Section 26

Time limit of the master's thesis, colloquium

- (1) The time limit for completing the master's thesis is 23 weeks at the most.
- (2) In individual cases, the time limit may upon justified application be prolonged by a maximum of six weeks by the examining board.
- (3) Topic, task and scope of the master's thesis are to be restricted by the supervisor so as to enable the time limit for completing the master's thesis to be kept.
- (4) The candidate elucidates his master's thesis during a colloquium.

Section 27

Academic degree

Following a passed master's examination, the Technische Universität Chemnitz awards the degree "Master of Science (M.Sc.)".

**Part 3
Final provisions**

**Section 28
Effective date and publication**

The examination regulations are applicable to those enrolled from the winter semester 2015/2016.

The examination regulations take effect from the day after their publication in the Official Publications (Amtliche Bekanntmachungen) of the Technische Universität Chemnitz.

Issued on the basis of the decision of the faculty board of the Faculty of Natural Sciences from ... and the approval of the University Management of the Technische Universität Chemnitz from

Chemnitz, ...

The Rector
of the Technische Universität Chemnitz

Prof. Dr. Arnold van Zyl