FH MÜNSTER
University of Applied Sciences

MODULHANDBUCH / MODULE GUIDE

Master

Chemical Engineering (CE)

mit den fachlichen Ausrichtungen /
with specialisation in

Applied Chemistry (AC)
Chemical Processing (CP)

Prüfungsordnung 2013
Änderungsordnung 08/2023
Aktualisiert 08/2026

Informationen zu Wahlpflichtkatalogen:

Das Angebot der Wahlpflichtmodule gliedert sich in Wahlpflichtkatalog 1 (Angebot aus dem Fachbereich Chemieingenieurwesen) und Wahlpflichtkatalog 2 (gemeinsames Angebot Campus Steinfurt).

Die Wahlpflichtkataloge 1 und 2 unterliegen der laufenden Aktualisierung. Vor Beginn des Semesters wird das aktuelle Angebot der einzelnen Kataloge veröffentlicht.

Für den Studiengang Master Chemical Engineering sind aus dem Wahlpflichtkatalog 1 Module im Umfang von mindestens 42 Leistungspunkten zu wählen. Aus dem Wahlpflichtkatalog 2 können Module im Umfang von maximal 12 Leistungspunkten gewählt werden.

Dieses Modulhandbuch beinhaltet die Module des Wahlpflichtkatalogs 1 des Fachbereichs Chemieingenieurwesen. Die Beschreibungen der Module aus dem Wahlpflichtkatalog 2 erhalten Sie im jeweiligen Fachbereich, bei dem das Modul angesiedelt ist.

Information on compulsory elective catalogs:

The range of compulsory elective modules is divided into compulsory elective catalog 1 (offered by the Department of Chemical Engineering) and compulsory elective catalog 2 (offered jointly by the Steinfurt Campus).

Compulsory elective catalogs 1 and 2 are subject to continuous updating. The current offerings of the individual catalogs are published before the start of the semester.

For the Master's degree program in Chemical Engineering, modules comprising at least 42 credit points must be selected from compulsory elective catalog 1. Modules amounting to a maximum of 12 credit points can be selected from compulsory elective catalog 2.

This module handbook contains the modules of the compulsory elective catalog 1 of the Department of Chemical Engineering. The descriptions of the modules from compulsory elective catalog 2 can be obtained from the respective department in which the module is located.

Abkürzungen / Abbreviations:

SoSe	-	Vorlesung im Sommersemester, Lecture in Summerterm
WiSe	-	Vorlesung im Wintersemester, Lecture in Winterterm
AC	-	Vertiefungsrichtung Applied Chemistry
CP	-	Vertiefungsrichtung Chemical Processing
MSE	-	Angebot für den Master Materials Science and Engineering

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Studienverlaufsplan / Study course plan

Master Chemical Engineering - specialization in Applied Chemistry or Chemical Processing

Abkürzungen

V = Lecture
Ü = exercise
P = lab course
S = Seminar
SWS = Semesterwochenstunde
PE = exam
MP = module examination
LP = Leistungspunkte (Credits)

The study course plan is a general structure.
The distribution between lecture, exercise, seminar, housework and lab course can vary from module to module.
Details can be found in the respective module description.

Modul	1. Semester SWS					2. Semester SWS					∑	
	V	Ü/ S	P	LP	PE	V	Ü/ S	P/ aV	LP	PE	SWS	LP
Pflichtmodul 1 /Compulsory 1	3	1	3	8	MP						7	8
Wahlpflichtmodul 1*/ Elective 1	3	1	1	6	MP						5	6
Wahlpflichtmodul 2*/Elective 2	3	1	1	6	MP						5	6
Wahlpflichtmodul 3*/Elective 3	3	1	1	6	MP						5	6
Projektarbeit 1** /Projectwork		1		4	MP						1	4
Pflichtmodul 2 / Compulsory 2						3	1	3	8	MP	7	8
Wahlpflichtmodul 4*/Elective 4						3	1	1	6	MP	5	6
Wahlpflichtmodul 5*/Elective 5						3	1	1	6	MP	5	6
Wahlpflichtmodul 6*/Elective 6						3	1	1	6	MP	5	6
Projektarbeit 2**/Projectwork							1		4	MP	1	6
∑ Lehrveranstaltungsarten/LP Lectures / Credits	12	5	6	30		1 2	5	6	30		46	60
∑ SWS insgesamt	23			30		23			30		46	60

Modul	3. Semester SWS					4. Semester SWS					∑	
	V	Ü/ S	P/ aV	LP	PE	V	Ü	P	LP	PE	SWS	LP
Pflichtmodul 3 / Comulsory 3	3	1	3	8	MP						7	8
Wahlpflichtmodul 7* /Elective 7	3	1	1	6	MP							6
Wahlpflichtmodul 8* /Elective 8	3	1	1	6	MP							6
Wahlpflichtmodul 9* /Elective 9	3	1	1	6	MP							6
Projektarbeit 3**/Projektwork		1		4	MP							4
Masterarbeit /Thesis									27			27
Kolloquium									3			3
∑ Lehrveranstaltungsarten/LP Lectures / Credits	1 2	5	6	30					30			
∑ SWS insgesamt	23			30					30			60

* Compulsory elective modules with 6 credits can be completed by two elective modules with 3 credits each (see module list) to be replaced.

** The workload of a project work includes about 120 hours and is accompanied by a seminar. The project module thus covers about 360 hours.

Pflichtmodule / Compulsory modules

1	1.1 Title of module (GER / ENG)	1.2 Short description (optional)	1.3 Module code (from HIS-POS)
	Advanced Inorganic Chemistry	AIC	**CIW.2.0004.0.M***
2	2.1 Cycle of module: ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	2.2 Duration of module ☒ **1 semester** ☐ **2 semesters**	
3	3.1 Module offered in the following study programme(s):	3.2 Compulsory **(Pf)**, compulsory elective **(WPf)**, elective **(W)**	3.3 Recommended semester:
	M.Sc. Chemical Engineering – Applied Chemistry	Pf	1./3.
	M.Sc. Materials Science and Engineering	WPf	1./3.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**240**	**8**
	Übung / Exercise	1	15		
	Praktikum / Lab course	3	45		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 7	Sum contact hours in hrs. 105		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*7*	90		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**9**	Sum self-study in hrs 135		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students have become aware of the change, the interpretation of chemical bonds and understand advanced concepts of bonding beyond pure covalent/ionic bonding. They are accustomed to the principles of valence bond and molecular orbital theory. The students can furthermore interpret electronic spectra of inorganic solid state, organometallic or coordination compounds. They have acquired an essential understanding of stability and reaction mechanisms of coordination and organometallic compounds and catalytic cycles based on these. Founded on such background and fellow student presentations on these subjects, they understand the practical examples such as LEDs, OLEDs, as well as Si, GaAs, CIGS, perovskite, and Graetzel solar cells.

Where applicable, presentations from guest speakers will have brought them into contact with contemporary problems in inorganic chemistry and close-by disciplines.

5.2 Course content

Role of Inorganic Chemistry

Cosmo and astrochemistry
Nuclear fusion and disintegration processes, radiation chemistry, formation of inorganic compounds, formation of precursors of life, chemistry under extreme high- or low-pressure conditions, chemistry in strong E-, G-, or H-fields

Symmetry and group theory
Symmetry elements, symmetry of molecules, point groups, character tables, transformations, Mulliken symbols. Implications for orbitals and electronic states and optical spectroscopy

Coordination compounds
Structure and reactivity, inner and outer sphere reaction mechanisms, Eyring theory

Ligand field and MO theory for coordination compounds
Overlap integral and orbital symmetry / orbital energy, correlation diagrams of molecules and transition metal complexes, revisit of the Jahn-Teller effect, charge transfer,

Intervalence complexes
Types and classification according to Robin and Day, application of charge-transfer processes

Spectroscopy of inorganic compounds
Selection rules, d-d, f-d, and f-f transitions, charge transfer and band-to-band transitions, revisit of the spectrochemical series, Raman- and Resonance-Raman-Spectroscopy

Organometallic chemistry
18-electron rule and exceptions, organometallic bonding, polarity and reactivity of M-C bonds, reaction mechanisms, main group organometallics, transition metal organometallics

Catalysis in inorganic chemistry
Selected industrial samples (Haber-Bosch, CO_2 activation, electrochemical water splitting, Ziegler-Natta, Fischer-Tropsch, Monsanto process, Hydroformylation, Electrochlorination)

Basics of bioinorganic chemistry

Lanthanide and actinide chemistry
The f-orbitals, energy levels and electronic spectra, lanthanide shrinkage, applications in organic synthesis

Advanced bonding concepts in inorganic chemistry
Unusual bonding states, Shannon-type ionic radii, bond-valence concept, brief overview of computational access to bonding in compounds (e.g. HF, DFT methods)

Compounds with mixed bonding character and their properties
Polycations, polyanions, sub-valent compounds, intermetallic phases

Technologically important inorganic compounds
Oxide materials, non-oxide ceramics (carbides, nitrides, halides), framework materials, cluster compounds

Selected application areas
Heterogenous electrocatalysis, solar cells, organic light emitting diodes, storage materials

<u>Lab work</u>
As practical examples, in which several specific electronic properties merge to make up a device, a Graetzel type solar cell based on a Ru^{2+} complex as well as a plant dye, and OLEDs using Al-trisquinolinate (Alq_3) or an Eu-complex [$Eu(ttfa)_3$phen] complex will be manufactured. The active components, i.e. the Ru^{2+}

complex, Alq_3, and $[Eu(ttfa)_3phen]$ are synthesized and then thoroughly characterized spectroscopically. The optoelectronic properties of the fabricated devices will be characterized as exhaustive as possible.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in Chemical Engineering, Chemistry, Materials Sciences, or closely related

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Written report on laboratory experiments, oral presentation of assigned subject and successful examination.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Oral presentation on inorganic subject as assigned.
Written exam (180 minutes) or oral examination

6.4 Requirements for admission to examination

Complete participation in the required laboratory work and approval of the associated reports.
Enrollment in the study program, registration for the examination (via myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr. Thomas Jüstel

7.3 Professors (optional)

Prof. Dr. Thomas Jüstel, Prof. Dr. Joachim Breternitz

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Lecture notes, tables, work sheets (as made available on ILIAS and/or lecturers homepages)
J.E. Huheey, E.A. Keiter, R.L. Keiter, “Inoganic Chemistry-Principles of Structure and Reactivity”
F.A. Cotton & G. Wilkinson, “Advanced Inorganic Chemistry”
R. Pöttgen, T. Jüstel, C. Strassert, “Rare Earth Chemistry” and “Applied Inorganic Chemistry”
C. Janiak, H.-J. Meyer, D. Gudat, P. Kurz, “Riedel Moderne Anorganische Chemie“ (in German)
Selected publications from “Advanced Materials”, “Angewandte Chemie”, „Chemie in unserer Zeit“, „Inorganic Chemistry“, “Nature”, “Science”, and “ZAAC”

1	**1.1 Title of module (GER / ENG)** Advanced Organic Chemistry	**1.2 Short description (optional)** AOC	**1.3 Module code** (from HIS-POS) **CIW.2.0005.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	Pf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total **Workload in hours** sum contact hours and self-study in hrs.	**ECTS (credit points)** generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**240**	**8**
	Übung / Exercise	1	15		
	Praktikum / Lab course	3	45		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 7	Sum contact hours in hrs. 105		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*6*	90		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**9**	Sum self-study in hrs 135		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students are very familiar with reactions and synthesis of selected compound classes.
They know how to use theoretical models of chemical bonding, to explain and to predict the stereochemical results in pericyclic reactions. The students are able to classify the different methods of asymmetric synthesis and they know some important examples.

5.2 Course content

Review on theoretical aspects
- chemical bonding
- reaction type's

Stereochemistry
- conformation, regioisomers, stereoisomers, chirality
- stereoselective synthesis, asymmetric synthesis,

Pericyclic reactions
- Electrocyclic reactions
- Cycloadditions
- sigmatropic rearrangements

Laboratory:
A given target molecule is to be synthesized.
The steps are: Literature research, planning and execution of the synthesis, taking into account the necessary safety requirements, characterization and quality control of the product.
The students present the synthesis plan in an oral presentation and have to write a scientific report.
→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor's degree in chemical engineering, chemistry, or a closely related discipline.
Good basic knowledge of organic chemistry (mechanisms, properties of functional groups, synthesis methods) are expected and required.
For safety reasons, good laboratory skills are a prerequisite for participation in the practical laboratory course for this module. (Laboratory skills can be acquired beforehand in the module "Project Work 1 - Laboratory / Laboratory Internship").

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Certificate of lab work and successful exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Written exam (180 minutes) or oral examination

6.4 Requirements for admission to examination

Regular participation in the lab work and approval of the associated reports.
Enrollment in the programme, register for the examination (via myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr. Andreas Weiper-Idelmann

7.3 Professors (optional)

Prof. Dr. Andreas Weiper-Idelmann

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Recommendations are given in the lecture

1	**1.1 Title of module (GER / ENG)** Advanced Physical Chemistry	**1.2 Short description (optional)** APC	**1.3 Module code** (from HIS-POS) **CIW.2.0006.0.M*** **CIW.2.0007.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	Pf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Materials Science and Engineering	WPf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45 (45)	**240 (AC)** **180 (CP/MSE)**	**8 (AC)** **6 (CP/MSE)**
	Übung / Exercise	1 (2)	15 (30)		
	Praktikum / Lab course	3 (0)	45 (0)		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 7 (5)	Sum contact hours in hrs. 105 (75)		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und des Seminars Preparation and revision of lectures and seminar	*6*	90 (90)		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*2 (0)*	30 (0)		
	Kooperative Bearbeitung weitergehender Fragestellungen Cooperative preparation and discussion of additional material	*1*	15 (15)		
	Sum	**9 (7)**	Sum self-study in hrs 135 (105)		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Students can develop and understand physico-chemical models of real systems with emphasis on molecular modelling, vapour/liquid-equilibria, and statistical thermodynamics. They are able to evaluate the results of modelling critically, balancing assumptions, limits and computational effort in a rational way.

5.2 Course content

Molecular modelling:
hierarchy of computational methods, limitations and restrictions, fundamentals of quantum chemistry, Hamiltonians, Born-Oppenheimer approximation, H-like atomic orbitals, molecular orbitals and Aufbau

principle, Pauli´s principle, LCAO method, Hartree-Fock approximation, basis sets, semiempirical approximations, electron correlation, density functional theory, molecular mechanics, molecular dynamics.

Statistical thermodynamics:
Macrostates and microstates, probabilities and entropy, Fermi-Dirac, Bose-Einstein and Boltzmann distribution, partition functions, degeneracy, thermodynamic potentials, translation, rotation, vibration, Debye´s model of the solid state, metals, Fermi energy

Quantitative equilibrium relations and calculations:
Systematics of excess functions in mixtures, activity coefficients, regular models, calculation of excess functions, phase diagrams and McCabe-Thiele diagrams, models of local composition in non-regular mixtures, NRTL-model, miscibility gaps, UNIQUAC, UNIFAC, (extended) Debye-Hückel-model

Lab/Seminar:
Molecular modelling projects with ab initio and DFT methods are available for the compulsory variant of the module. Students from the “Chemical Processing” direction present modelling of liquid/vapour equilibria. Students from “Materials Science and Engineering” present the results of a literature research. All these elements are part of the seminar and require oral contributions in front of the class as well as written reports (workload adjusted to credits).

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelor degree in Chemical Engineering, Chemistry or a closely related subject
Topics of Physical Chemistry from a B.Sc.-programme in Chemistry, Chemical Engineering or similar course programmmes

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Pass lab exercises (written report and seminar contribution) and exam

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Quality of seminar contribution; criteria to be announced at course start (25% of grade points)
Quality of lab/seminar report; criteria to be announced at course start (25% of grade points)
Exam (120 minutes written, or oral) after the course (50% of grade points)

6.4 Requirements for admission to examination
Participation in seminar
Enrollment in the programme, registration for examination (via myFH-Portal)

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr. Steffen Neitzel-Grieshammer

7.3 Professors (optional)
Prof. Dr. Steffen Neitzel-Grieshammer

7.4 Maximum number of participants (optional)
7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.) 1. Lecture notes (available under Ilias) 2. Atkins: Physical Chemistry (Oxford) 3. Cooksy: Quantum Chemistry and Molecular Interactions (Pearson) 4. Cooksy: Thermodynamics: Statistical Mechanics, & Kinetics (Pearson)

1	**1.1 Title of module (GER / ENG)** Heat and Mass Transfer	**1.2 Short description (optional)** HMT	**1.3 Module code** (from HIS-POS) **CIW.2.0026.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Chemical Processing	Pf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total **Workload in hours** sum contact hours and self-study in hrs.	**ECTS (credit points)** generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**240**	**8**
	Übung / Exercise	1	15		
	Praktikum / Lab course	3	45		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 7	Sum contact hours in hrs. 105		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*6*	90		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**9**	Sum self-study in hrs 135		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students are familiar with the details of the boundary layer theory and the similarity theory and they are able to solve complex heat and mass transfer problems including comprehensive dimensionless descriptions.

5.2 Course content

Similarity theory, boundary layer theory, convective heat transfer, heat transfer by conduction and radiation, analogy of transport mechanisms, diffusive mass transfer, transient mass transfer, Boiling and Condensation, Finite Difference Method.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6	**6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)* Solid knowledge of heat and mass transfer Bachelor degree in Chemical Engineering, Chemistry or closely related
	6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation) Proof of lab work and pass the exam. Praktikumsnachweis und Bestehen der Prüfung.
	6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes) Written tasks and / or oral presentations on practical experiments. Exam (120 minutes) or oral exam
	6.4 Requirements for admission to examination Regular participation in the lab work and Recognition of the associated reports. Enrollment in the programme, register for the examination (via myFH-Portal). Regelmäßige Teilnahme am Praktikum und Anerkennung der zugehörigen Ausarbeitungen. Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal).
	6.5 Weighing of module grade when calculating final grade see examination regulations for aforementioned study programmes (line 3).* *You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.
7	**7.1 Languages used in the module:** ☐**German** ☒ **English** ☐ **others, namely:**
	7.2 Contact person for module: Prof. Dr.-Ing. Mirjam Altendorfner
	7.3 Professors (optional) Prof. Dr.-Ing. Mirjam Altendorfner
	7.4 Maximum number of participants (optional)
	7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.) Manuscript (Recommendations are given in the lecture)

1	**1.1 Title of module (GER / ENG)** Advanced Unit Operations	**1.2 Short description (optional)** AUO	**1.3 Module code** (from HIS-POS) **CIW.2.0008.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Chemical Processing	Pf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**240**	**8**
	Übung / Exercise	1	15		
	Praktikum / Lab course	3	45		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 7	Sum contact hours in hrs. 105		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*6*	90		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**9**	Sum self-study in hrs 135		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Unit operations are a set of building blocks that can be used to design a complete chemical, pharmaceutic, or petrochemical plant. The unit operations framework was defined to provide method and structure to the synthesis and analysis of chemical plants, as well as to establish a rational and systematic path for performing process design calculations.
Based on existing undergraduate capabilities, students achieve in this course advanced knowledge about **thermal** unit operations.

By means of intensive lectures, flanking exercises, and a supporting lab course program the participants are able to select the most appropriate unit operations for a certain design case dependent from existing process constraints and resulting operation regimes. They can formulate and solve material and energy balances for binary and multicomponent separations. In addition, they can apply empirical, analytical, and classical graphical methods used for the dimensioning of unit operations. The obtained knowledge enables students to perform all relevant design calculations.

5.2 Course content

Chemical Engineering differs from other engineering disciplines by introducing two particular subjects into the scope of activities: these are chemical reactions on one hand, and mass transfer between various phases on the other. The course “Advanced Unit Operations” deals with the subject of mass transfer applications in cases, where multicomponent fluid and/or solid phases need to be separated. For this purpose, so-called “Mechanical and Thermal Unit Operations” were introduced. This are operations being essentially similar particular in respect to the involved phases – to a great extend independent from the chemical substances to be separated.

This course focusses on Thermal Unit Operations. Based on the stage theory, topics include unit operations as evaporation/condensation, absorption, distillation/rectification, liquid–liquid extraction, drying, and crystallisation. The different modes of every unit operation will be introduced by graphical design methods. However, the fundamentals of chemical thermodynamics be concerned with by developing specific heat and mass transfer balances for every unit operation considered in the course. Whenever needed, hydrodynamic topics are included.

Lab course:
- Drying experiment
- Extraction in a mixer-settler-plant (experiment + simulation)
- Batch distillation (simulation)
- Continuous distillation (experiment + simulation)
- Column design

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Solid knowledge in Process Engineering
Bachelor degree in Chemical Engineering or in a similar study programme.
It is a condition that the auditory has already received basic knowledge about the fundamentals of thermal unit operations.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Approved lab reports.
Successful passing of the examination.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Written tasks and / or oral presentations on practical experiments.
Exam (120 minutes) or oral exam

6.4 Requirements for admission to examination

Enrollment in the programme, register for the examination (via myFH-Portal).
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**

☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module: Prof. Dr.-Ing. Joachim Guderian
7.3 Professors (optional) Prof. Dr.-Ing. Joachim Guderian
7.4 Maximum number of participants (optional)
7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.) Lecture notes are available via ILIAS, Handouts Literature: Seader and Henley: Separation process principles - Wiley 1998 and 2013 Sattler, Feindt: Thermal Separation Processes – ebook, Wiley 2008

1	**1.1 Title of module (GER / ENG)** Chemical Reaction Engineering	**1.2 Short description (optional)** CRE	**1.3 Module code** (from HIS-POS) **CIW.2.0015.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Chemical Processing	Pf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**240**	**8**
	Übung / Exercise	1	15		
	Praktikum / Lab course	3	45		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 7	Sum contact hours in hrs. 105		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*7*	105		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*2*	30		
	Sum	**9**	Sum self-study in hrs 135		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students can design and optimize reactors based on their knowledge in chemical thermodynamics, complex reaction stoichiometry and kinetics. The students can determine the influence of mass transfer in boundary layers and porous catalyst particles on the effective kinetics. The students can design experiments and evaluate experimental data for the determination of kinetics and reactor performance (yield, selectivity, conversion). The students can use a process simulator to design and optimize a reactor.

In a team project they apply their reaction engineering competences for designing a reactive process. The students are able to break down the complex process of designing a chemical reactor into subtasks and solve them effectively as a group by applying their technical knowledge. They can present their results in a written report and oral presentations on professional level.

5.2 Course content

Introduction and knowledge necessary from Bachelor program

Chemical Thermodynamics and equilibrium calculation for ideal and real system

Multi reaction systems and reactor choice

Nonelementary reaction kinetics:
Adsorption isotherms, surface reaction, Langmuir mechanism, Eley-Rideal mechanism, Hougen-Watson mechanism

Kinetics of heterogeneous reaction:
Sorption processes, physical properties of catalytic surfaces, mass and heat transport effects on catalytic reactions, diffusion, characterizing mass and heat transport effects, mass transfer resistance, heat transfer resistance, aging of catalysts

Design of fixed bed reactors:
Pressure drop, changing reaction volume, catalyst decay

Design of experiments

Lab: Experimental lab task and simulation tasks

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in Chemical Engineering, Chemistry, or closely related

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Lab report and passing the exam.
Praktikumsnachweis und Bestehen der Prüfung.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Written lab reports and / or oral presentations on practical experiments.
Written exam (180 minutes) or oral exam.

6.4 Requirements for admission to examination

Regular participation in the lab training and recognition of the associated reports
Enrollment in the programme, registration for the examination (via myFH-Portal)

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr.-Ing. Volkmar Jordan

7.3 Professors (optional)

Prof. Dr.-Ing. Volkmar Jordan

7.4 Maximum number of participants (optional)
7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.) Literature: Scott Fogler, Elements of Chemical Reaction Engineering; Prentice Hall International, London 1999 O. Levenspiel, Chemical Reaction Engineering; John Wiley & Sons, New York 1999

Projektmodul / Project module

Prüfungsordnung 2013

Projektarbeit 1	Literaturrecherche	4 CP	1/3 der Gesamtnote
Projektarbeit 2	Projektarbeit – Labor	4 CP	1/3 der Gesamtnote
Projektarbeit 3	Projektarbeit – Labor	4 CP	1/3 der Gesamtnote

Änderungsordnung 2023

Projektarbeit 1	Laborpraktikum (for international students) Projektarbeit – Labor (freie Themenwahl, falls Laborerfahrung nachgewiesen warden kann)	4 CP	unbenotet
Projektarbeit 2	Literaturrecherche	4 CP	1/2 der Gesamtnote
Projektarbeit 3	Projektarbeit – Labor	4 CP	1/2 der Gesamtnote

1	**1.1 Title of module (GER / ENG)** Projektarbeit 1 – Literaturrecherche (PO 2013)	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0043.1.V**
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	Pf	1.
	M.Sc. Chemical Engineering – Chemical Processing	Pf	1.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total **Workload in hours** sum contact hours and self-study in hrs.	**ECTS (credit points)** generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Anleitung durch Betreuer / Supervision	2	30	**120**	**4**
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 2	Sum contact hours in hrs. 30		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Hausarbeit	*6*	90		
	Sum	**6**	Sum self-study in hrs 90		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Die Studierenden sind in der Lage, den Stand der Literatur zu recherchieren, zu lesen, zu verstehen und zu zitieren und in einen Bericht zusammenzufassen und zu bewerten.

Students are able to search the literature available, to read, to understand and to critically select the results. They can write a comprehensive review.

5.2 Course content

Das Thema der Literaturrecherche kann von jeder hauptamtlich lehrenden Person ausgegeben und betreut werden.
Die Literaturrecherche ist eine Einzelarbeit. Sie besteht aus einer Ausarbeitung von in der Regel 15 bis 20 Seiten DIN A4 (ca. 2000 Zeichen je Seite) Umfang, die im Rahmen der Bearbeitung des Themas erstellt wird.

The project topic can be provided and supervised by any full-time lecturer.
The project is an individual work. It consists of an elaboration of usually 15 to 20 pages DIN A4 (about 2000 characters per page), which is created during the implementation of the project.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelorabschluss in Chemie, Chemieingenieurwesen oder ähnlicher Fachrichtung.
Bachelor degree in Applied Chemistry or Chemical Engineering, Chemistry or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Ausfüllen des Antrags auf Projektarbeit Formblatt Hompage:
Application Project work, see form Homepage:
https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit_PO_2013_-_Formular.pdf

Auswertung und Dokumentation der Literaturrecherche, Bericht, Report.
Abgeben der Bewertung auf dem Formblatt im Prüfungsamt.

Delivering the grade on the form to the Examinations Office.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Bericht und Präsentation
Report and presentation

6.4 Requirements for admission to examination

Einschreibung im Studiengang, fristgerechte Anmeldung zur Projektarbeit auf dem Formular.
Enrollment in the programme, application for project work.

https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit_PO_2013_-_Formular.pdf

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prüfungsausschussvorsitzender
Chairman of the examination board

7.3 Professors (optional)

Dozenten FH Münster
Lecturers / Professors of the University of Applied Sciences Münster

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

1	**1.1 Title of module (GER / ENG)** Projektarbeit 2 – Labor (PO 2013)	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0043.2.V**
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	Pf	2.
	M.Sc. Chemical Engineering – Chemical Processing	Pf	2.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total **Workload in hours** sum contact hours and self-study in hrs.	**ECTS (credit points)** generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Wissenschaftliches Arbeiten / Scientific work	6	90	**120**	**4**
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Hausarbeit / Homework	*2*	30		
	Sum	**2**	Sum self-study in hrs 30		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Die Studierenden haben die Fähigkeit entwickelt, innerhalb einer vorgegebenen Frist eine wissenschafts- oder praxisorientierte Aufgabenstellung unter Verwendung modulübergreifender Lösungsansätze methodisch folgerichtig und nach wissenschaftlichen Methoden erfolgreich zu bearbeiten. Sie sind in der Lage, ihre erarbeiteten Ergebnisse klar verständlich und plausibel schriftlich und mündlich darzustellen und sich einer Diskussion vor fachkundigem Publikum zu stellen.

The students demonstrate that within a specified period they are able to work on a solution for a scientific / practical problem. They are able to use interdisciplinary logical and methodological approaches.
They can present their compiled results clearly, understandable and plausible in written and oral form and they will be able to defend the results in a discussion.

5.2 Course content

Das Thema der Projektarbeit kann von jeder hauptamtlich lehrenden Person ausgegeben und betreut werden.
Die Projektarbeit ist eine Einzelarbeit. Sie besteht aus einer Ausarbeitung von in der Regel 15 bis 20 Seiten DIN A4 (ca. 2000 Zeichen je Seite) Umfang, die im Rahmen der Bearbeitung des Projekts erstellt wird. Sie wird durch einen Vortrag mit abschließender Befragung von max. 30 Minuten Dauer je Kandidatin oder Kandidat ergänzt.
Das gesamte Projektmodul (Literaturrecherche, Projektarbeit 2 und Projektarbeit 3) muss von zwei verschiedenen Lehrenden betreut werden.

The project topic can be provided and supervised by any full-time lecturer.
The project is an individual work. It consists of an elaboration of usually 15 to 20 pages DIN A4 (about 2000 characters per page) size, which is created during the implementation of the project. It is supplemented by an oral presentation and defense of max. 30 minutes duration.
The complete project module (literature research, project work 2 and project work 3) must be supervised by two different lectures.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelorabschluss in Chemie, Chemieingenieurwesen oder ähnlicher Fachrichtung.
Bachelor degree in Applied Chemistry or Chemical Engineering, Chemistry or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Ausfüllen des Antrags auf Projektarbeit Formblatt Hompage:
Application Project work, see form Homepage:
https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit_PO_2013_-_Formular.pdf

Auswertung und Dokumentation der Projektarbeit, Bericht und mündliche Präsentation.
Abgeben der Bewertung auf dem Formblatt im Prüfungsamt.

Report and oral presentation / Delivering the grade on the form to the Examinations Office.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Bericht und mündliche Präsentation / Report and oral presentation.

6.4 Requirements for admission to examination
Einschreibung im Studiengang, fristgerechte Anmeldung zur Projektarbeit auf dem Formular.
Enrollment in the programme, application for project work.

https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit_PO_2013_-_Formular.pdf

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prüfungsausschussvorsitzender
Chairman of the examination board

7.3 Professors (optional)
Dozenten FH Münster
Lecturers / Professors of the University of Applied Sciences Münster

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

1	**1.1 Title of module (GER / ENG)** Projektarbeit 3 – Labor (PO 2013)	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0043.3.V**
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	Pf	3.
	M.Sc. Chemical Engineering – Chemical Processing	Pf	3.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total **Workload in hours** sum contact hours and self-study in hrs.	Workload in total **ECTS (credit points)** generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Wissenschaftliches Arbeiten / Scientific work	6	90	**120**	**4**
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Hausarbeit / Homework	*2*	30		
	Sum	**2**	Sum self-study in hrs 30		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Die Studierenden haben die Fähigkeit entwickelt, innerhalb einer vorgegebenen Frist eine wissenschafts- oder praxisorientierte Aufgabenstellung unter Verwendung modulübergreifender Lösungsansätze methodisch folgerichtig und nach wissenschaftlichen Methoden erfolgreich zu bearbeiten. Sie sind in der Lage, ihre erarbeiteten Ergebnisse klar verständlich und plausibel schriftlich und mündlich darzustellen und sich einer Diskussion vor fachkundigem Publikum zu stellen.

The students demonstrate that within a specified period they are able to work on a solution for a scientific / practical problem. They are able to use interdisciplinary logical and methodological approaches.
They can present their compiled results clearly, understandable and plausible in written and oral form and they will be able to defend the results in a discussion.

5.2 Course content

Das Thema der Projektarbeit kann von jeder hauptamtlich lehrenden Person ausgegeben und betreut werden.
Die Projektarbeit ist eine Einzelarbeit. Sie besteht aus einer Ausarbeitung von in der Regel 15 bis 20 Seiten DIN A4 (ca. 2000 Zeichen je Seite) Umfang, die im Rahmen der Bearbeitung des Projekts erstellt wird. Sie wird durch einen Vortrag mit abschließender Befragung von max. 30 Minuten Dauer je Kandidatin oder Kandidat ergänzt.
Das gesamte Projektmodul (Literaturrecherche, Projektarbeit 2 und Projektarbeit 3) muss von zwei verschiedenen Lehrenden betreut werden.

The project topic can be provided and supervised by any full-time lecturer.
The project is an individual work. It consists of an elaboration of usually 15 to 20 pages DIN A4 (about 2000 characters per page) size, which is created during the implementation of the project. It is supplemented by an oral presentation and defense of max. 30 minutes duration.
The complete project module (literature research, project work 2 and project work 3) must be supervised by two different lectures.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelorabschluss in Chemie, Chemieingenieurwesen oder ähnlicher Fachrichtung.
Bachelor degree in Applied Chemistry or Chemical Engineering, Chemistry or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Ausfüllen des Antrags auf Projektarbeit Formblatt Hompage:
Application Project work, see form Homepage:
https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit_PO_2013_-_Formular.pdf

Auswertung und Dokumentation der Projektarbeit, Bericht und mündliche Präsentation.
Abgeben der Bewertung auf dem Formblatt im Prüfungsamt.

Report and oral presentation / Delivering the grade on the form to the Examinations Office.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Bericht und mündliche Präsentation / Report and oral presentation.

6.4 Requirements for admission to examination
Einschreibung im Studiengang, fristgerechte Anmeldung zur Projektarbeit auf dem Formular.
Enrollment in the programme, application for project work.

https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit_PO_2013_-_Formular.pdf

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prüfungsausschussvorsitzender
Chairman of the examination board

7.3 Professors (optional)
Dozenten FH Münster
Lecturers / Professors of the University of Applied Sciences Münster

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

1	**1.1 Title of module (GER / ENG)** Project Work 1 - Laboratory / Laboratory Internship / Projektarbeit 1 – Labor / Laborpraktikum (ÄO 2023)	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0072.1.V**
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	Pf	1.
	M.Sc. Chemical Engineering – Chemical Processing	Pf	1.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Wissenschaftliches Arbeiten / Scientific work	6	90	**120**	**4**
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Hausarbeit / Homework	*2*	30		
	Sum	**2**	Sum self-study in hrs 30		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Diese Projektarbeit dient der Einführung in die Arbeit im chemischen Laboratorium und wird in Gruppen durchgeführt.
Sollten bereits einschlägige Erfahrungen zur Arbeit im chemischen Labor nachgewiesen werden, kann das Thema dieser ersten Projektarbeit frei gewählt werden.

This project work serves to develop and improve basic laboratory skills as a basis for the laboratory practicals of the Master's programme.

5.2 Course content

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 6.1 Prerequisits (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelorabschluss in Chemie, Chemieingenieurwesen oder ähnlicher Fachrichtung.
Bachelor degree in Applied Chemistry or Chemical Engineering, Chemistry or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Ausfüllen des Antrags auf Projektarbeit Formblatt Hompage:
Application Project work, see form Homepage:
https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit___nderung_der_PO_2013.pdf

Auswertung und Dokumentation der Laborarbeit.
Abgeben der Bewertung auf dem Formblatt im Prüfungsamt.

Delivering the grade on the form to the Examinations Office.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Die erste Projektarbeit fließt NICHT in die Gesamtnote des Projektmoduls ein.

6.4 Requirements for admission to examination

Einschreibung im Studiengang, fristgerechte Anmeldung zur Projektarbeit auf dem Formular.
Enrollment in the programme, application for project work.

https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit___nderung_der_PO_2013.pdf

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prüfungsausschussvorsitzender
Chairman of the examination board

7.3 Professors (optional)

Dozenten FH Münster
Lecturers / Professors of the University of Applied Sciences Münster

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

1	**1.1 Title of module (GER / ENG)** Projektarbeit 2 – Literaturrecherche (ÄO 2023)	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0072.2.V**
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	Pf	2.
	M.Sc. Chemical Engineering – Chemical Processing	Pf	2.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total **Workload in hours** sum contact hours and self-study in hrs.	**ECTS (credit points)** generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Anleitung durch Betreuer / Supervision	2	30	**120**	**4**
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 2	Sum contact hours in hrs. 30		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Hausarbeit	*6*	90		
	Sum	**6**	Sum self-study in hrs 90		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Die Studierenden sind in der Lage, den Stand der Literatur zu recherchieren, zu lesen, zu verstehen und zu zitieren und in einen Bericht zusammenzufassen und zu bewerten.

Students are able to search the literature available, to read, to understand and to critically select the results. They can write a comprehensive review.

5.2 Course content

Das Thema der Literaturrecherche kann von jeder hauptamtlich lehrenden Person ausgegeben und betreut werden.
Die Literaturrecherche ist eine Einzelarbeit. Sie besteht aus einer Ausarbeitung von in der Regel 15 bis 20 Seiten DIN A4 (ca. 2000 Zeichen je Seite) Umfang, die im Rahmen der Bearbeitung des Themas erstellt wird.

The project topic can be provided and supervised by any full-time lecturer.
The project is an individual work. It consists of an elaboration of usually 15 to 20 pages DIN A4 (about 2000 characters per page), which is created during the implementation of the project.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelorabschluss in Chemie, Chemieingenieurwesen oder ähnlicher Fachrichtung.
Bachelor degree in Applied Chemistry or Chemical Engineering, Chemistry or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Ausfüllen des Antrags auf Projektarbeit Formblatt Hompage:
Application Project work, see form Homepage:
https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit___nderung_der_PO_2013.pdf

Auswertung und Dokumentation der Literaturrecherche, Bericht, Report.
Abgeben der Bewertung auf dem Formblatt im Prüfungsamt.

Delivering the grade on the form to the Examinations Office.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Bericht und Präsentation
Report and presentation

6.4 Requirements for admission to examination

Einschreibung im Studiengang, fristgerechte Anmeldung zur Projektarbeit auf dem Formular.
Enrollment in the programme, application for project work.

https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit___nderung_der_PO_2013.pdf

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prüfungsausschussvorsitzender
Chairman of the examination board

7.3 Professors (optional)

Dozenten FH Münster
Lecturers / Professors of the University of Applied Sciences Münster

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

1	**1.1 Title of module (GER / ENG)** Projektarbeit 3 – Labor (ÄO 2023)	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0072.3.V**
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	Pf	3.
	M.Sc. Chemical Engineering – Chemical Processing	Pf	3.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total **Workload in hours** sum contact hours and self-study in hrs.	Workload in total **ECTS (credit points)** generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Wissenschaftliches Arbeiten / Scientific work	6	90	**120**	**4**
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Hausarbeit / Homework	*2*	30		
	Sum	**2**	Sum self-study in hrs 30		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Die Studierenden haben die Fähigkeit entwickelt, innerhalb einer vorgegebenen Frist eine wissenschafts- oder praxisorientierte Aufgabenstellung unter Verwendung modulübergreifender Lösungsansätze methodisch folgerichtig und nach wissenschaftlichen Methoden erfolgreich zu bearbeiten. Sie sind in der Lage, ihre erarbeiteten Ergebnisse klar verständlich und plausibel schriftlich und mündlich darzustellen und sich einer Diskussion vor fachkundigem Publikum zu stellen.

The students demonstrate that within a specified period they are able to work on a solution for a scientific / practical problem. They are able to use interdisciplinary logical and methodological approaches.
They can present their compiled results clearly, understandable and plausible in written and oral form and they will be able to defend the results in a discussion.

5.2 Course content

Das Thema der Projektarbeit kann von jeder hauptamtlich lehrenden Person ausgegeben und betreut werden.
Die Projektarbeit ist eine Einzelarbeit. Sie besteht aus einer Ausarbeitung von in der Regel 15 bis 20 Seiten DIN A4 (ca. 2000 Zeichen je Seite) Umfang, die im Rahmen der Bearbeitung des Projekts erstellt wird. Sie wird durch einen Vortrag mit abschließender Befragung von max. 30 Minuten Dauer je Kandidatin oder Kandidat ergänzt.
Das gesamte Projektmodul (Literaturrecherche, Projektarbeit 2 und Projektarbeit 3) muss von zwei verschiedenen Lehrenden betreut werden.

The project topic can be provided and supervised by any full-time lecturer.
The project is an individual work. It consists of an elaboration of usually 15 to 20 pages DIN A4 (about 2000 characters per page) size, which is created during the implementation of the project. It is supplemented by an oral presentation and defense of max. 30 minutes duration.
The complete project module (literature research, project work 2 and project work 3) must be supervised by two different lectures.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelorabschluss in Chemie, Chemieingenieurwesen oder ähnlicher Fachrichtung.
Bachelor degree in Applied Chemistry or Chemical Engineering, Chemistry or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Ausfüllen des Antrags auf Projektarbeit Formblatt Hompage:
Application Project work, see form Homepage:
https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit___nderung_der_PO_2013.pdf

Auswertung und Dokumentation der Projektarbeit, Bericht und mündliche Präsentation.
Abgeben der Bewertung auf dem Formblatt im Prüfungsamt.

Report and oral presentation / Delivering the grade on the form to the Examinations Office.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Bericht und mündliche Präsentation / Report and oral presentation.

6.4 Requirements for admission to examination
Einschreibung im Studiengang, fristgerechte Anmeldung zur Projektarbeit auf dem Formular.
Enrollment in the programme, application for project work.

https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Projektarbeit___nderung_der_PO_2013.pdf

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prüfungsausschussvorsitzender
Chairman of the examination board

7.3 Professors (optional)
Dozenten FH Münster
Lecturers / Professors of the University of Applied Sciences Münster

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Übersicht Wahlpflichtkatalog 1 / Overview of compulsory elective catalog 1

Wahlpflichtmodule WS2026/27
FBR-Beschluss 11.05.2026

Master Chemical Engineering	CP
Wahlpflichtmodule	18
Advanced Applied Polymer Chemistry	6
Advanced Physical Chemistry	6
Analytic of Plastics and Polymers	6
Anlagensicherheit	6
Applied Process Development	6
Bioprocess Engineering	6
Chemical Technology of Materials	6
Chromatographic Methods	6
Current Topics in Applied Materials Chemistry	3
Hazardous Substances: Regulations and Risk	6
Optical and Electrical Characterization of Materials	6
Particle Technology	6
Project Management	6
Sustainable and Environmental Engineering	3/6
Technology of Coatings	6

Wahlpflichtmodule SS2026
FBR-Beschluss 27.10.2025

Master Chemical Engineering	CP
Wahlpflichtmodule	18
Advanced Analytical Chemistry	6
Advanced Organic Materials	6
Aerosol- and Nanotechnology	6
Applied Crystallographic Methods	6
Biochemistry	6
Bioinorganic Chemistry	3/6
Chemical Engineering - CAE Project Tools	3
Chemical Sensors	6
Chemistry for Engineers	3
Computational Fluid Dynamics	6
Current Topics in Applied Materials Chemistry	
Electrochemistry - Basics and analytical applications	3/6
Incoherent Light Sources	6
Management Methods	6
Membrane Separations	6
Petroleum Refining Technology	6
Process Design	6
Science Slam und Wissenschaftskommunikation	3
Wasseraufbereitung – Technische und chemische Methoden	6

1	**1.1 Title of module (GER / ENG)** Current Topics in Applied Materials Chemistry	**1.2 Short description (optional)** CTAMC	**1.3 Module code** (from HIS-POS) **CIW.2.00xx.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1.-3.
	M.Sc. Materials Science and Engineering	WPf	1.-3.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total **Workload in hours** sum contact hours and self-study in hrs.	Workload in total **ECTS (credit points)** generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	1	15	**90**	**3**
	Seminar	2	30		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 3	Sum contact hours in hrs. 45		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3*	45		
	Sum	**3**	Sum self-study in hrs 45		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students acquire a detailed understanding of current research topics in applied materials chemistry and adjacent scientific fields. They will get in touch with research methodology and techniques that are required for successful research projects.
The students develop an understanding for the scientific research landscape in the field and identify relevant players that may be interesting for a future career.

5.2 Course content

1. Scientific content
   - Presentations of current research topics by the lecturers
   - Presentations by active researchers at FH Münster
   - Guest lectures from researchers outside FH Münster
2. Methodological content
   - Acquiring knowledge from a scientific presentation
   - Critical reception of scientific knowledge
   - Further research on scientific topics
   - Techniques to present scientific knowledge
   - Active presentations (oral/poster) of the students on chosen topics in inorganic materials chemistry

→ details can be found in course syllabus, recommended study plan etc.

	5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms. We will discuss current topics in materials chemistry and use these examples to acquire a deeper understanding on effective presentation techniques.
6	**6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)* Bachelor degree in Chemical Engineering, Chemistry, Materials Science or closely related.
	6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation) Active participation in the lecture and seminar series and passing of the examination.
	6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes) Homework assignment or presentation during the seminar.
	6.4 Requirements for admission to examination Active participation in the lecture and seminar series (80 % attendance). Letter of motivation addressed to the module responsible.
	6.5 Weighing of module grade when calculating final grade see examination regulations for aforementioned study programmes (line 3).* *You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.
7	**7.1 Languages used in the module:** ☐**German** ☒ **English** ☐ **others, namely:**
	7.2 Contact person for module: Prof. Dr. Joachim Breternitz
	7.3 Professors (optional) Prof. Dr. Joachim Breternitz, Prof. Dr. Thomas Jüstel, Prof. Dr. Michael Schäferling, Prof. Dr. Steffen Neitzel-Grieshammer
	7.4 Maximum number of participants (optional)
	7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.) Literature recommendations will be given during the lecture series.

1	**1.1 Title of module (GER / ENG)** Advanced Applied Polymer Chemistry	**1.2 Short description (optional)** AAPoC	**1.3 Module code** (from HIS-POS) **CIW.2.0075.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Materials Science and Engineering	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Seminar	2	30	**180**	**6**
	Project / group work	1	15		
	Practical course	3	45		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Preparation interim presentations	*1*	15		
	follow-up work, review of lab work & results	*3*	45		
	Research (literature & preparation of lab work)	*2*	30		
	Sum	**6**	Sum self-study in hrs 90		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students will elaborate and achieve the following competencies

- **Technical competence**: Deepening knowledge of polymer chemistry structure–property relationships and industrial applications, including the role of polymers in sustainable technologies (e.g. resource-efficient materials, lightweight design, durable products). Students can relate polymer choices to the UN Sustainable Development Goals (SDGs), in particular SDG 9 (Industry, innovation and infrastructure) and SDG 12 (Responsible consumption and production).
- **Methodological competence**: Ability to design and apply polymerization methods, processing techniques and analytical methods (e.g. mechanical, thermal, rheological characterization). Students can critically select methods considering energy efficiency, waste minimisation, recyclability and the use of bio-based feedstocks (SDG 7, 12, 13).
- **Application- industry and sustainability-related competencies**: Awareness of current industrial trends and challenges such as decarbonisation, circular economy, recycling technologies and regulatory frameworks (e.g. REACH). Students can transfer theoretical knowledge to practical, industry-relevant problems, critically assess environmental and societal impacts of polymer systems and propose improvements aligned with the SDGs (e.g. SDG 11, 12, 13, 14, 15).

- **EHS / Safety management competence**: Understanding and consistent application of Environment, Health and Safety (EHS) principles in experimental and project work. This includes risk assessments (e.g. handling of chemicals, waste, process conditions), safe laboratory practice, appropriate use of personal protective equipment (PPE), compliance with lab regulations and basic safety documentation. Students can integrate EHS and safety-by-design considerations into their project planning and evaluation, recognising the link between safe operations and sustainable development (e.g. SDG 3 “Good health and well-being”, SDG 8 “Decent work and economic growth”).
- **Communication competence**: Clear and concise oral and written communication of project goals, methodology, results and conclusions, including limitations and uncertainties. Students can present and discuss technical and sustainability-related aspects of polymer systems to different audiences (academic, industrial, possibly non-experts), and make SDG and EHS implications transparent.
- **Interdisciplinary collaboration skills:** Experience working with individuals from different scientific and engineering disciplines to approach & discuss problems from multiple perspectives. Students learn to integrate technical, economic, environmental and safety perspectives, and to coordinate tasks, responsibilities and timelines in complex project settings

Overall, this module fosters critical thinking and innovation in polymer chemistry and equips students with the skills needed to address complex real-world challenges in materials science, sustainability, EHS / safety management and industrial applications in line with the UN 2030 Agenda. The module is implemented as a problem-based learning (PBL) environment. Students work on open, practice-oriented problems rather than predefined recipes. They learn to identify knowledge gaps, formulate their own questions, search and critically evaluate information, and iteratively adapt their approach. This fosters self-directed learning, initiative and the ability to tackle unfamiliar problems – skills that are essential for industrial R&D, innovation and life-long learning.

5.2 Course content

The module is organised as a problem-based learning (PBL) project. Students are confronted with realistic, open-ended problem statements from polymer chemistry and industrial practice (e.g. “Develop a recyclable material concept for a specific application” or “Compare two polymer systems under technical, EHS and sustainability constraints”). There is no single “correct” solution; instead, students define their own objectives and strategies within the given framework.

Students work in teams on defined projects related to polymer chemistry in areas such as:

- Classification of polymers and structure–property relationships
- Differences in properties and applications of thermoplastics and thermoplastic elastomers
- Laboratory-scale and industrial polymer synthesis (synthetic vs. bio-based), including monomer selection, polymerisation routes and additive concepts
- Characterisation of physical, mechanical and thermal properties and their correlation with structure and processing history
- Industrial applications and processing (extrusion, injection moulding, compounding, etc.), product development and value chains
- Sustainable plastics and design for sustainability (durability, reparability, recyclability, substitution of critical or hazardous components)
- Strategies for plastics recycling (mechanical, chemical and emerging methods) within the context of circular economy and resource efficiency
- Life-cycle oriented thinking (e.g. resource and energy demand, emissions, waste) and alignment with selected SDGs
- EHS / safety management in polymer labs and industry: basic risk assessment, safe handling of chemicals and waste, process safety considerations, environmental and occupational health aspects related to polymers and their additives
- Problem-based learning (PBL): working with open-ended, authentic problems, self-directed learning, iterative refinement of research questions, methods and solutions.

In the seminar, the theoretical background related to the project topics (including SDG and EHS aspects) is conveyed interactively. Results from the laboratory experiments are discussed in detail, and follow-up tasks are agreed based on the findings. Throughout the course, interim status presentations are given and short written reports and/or reflective notes are prepared to document the entire project process.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

This seminar is designed to engage students in advanced, team-based projects that address cutting-edge challenges in polymer chemistry. You work in teams on advanced, practice-oriented projects in polymer chemistry with a strong focus on sustainability (SDGs) and EHS/safety. You synthesize and characterize polymers, develop solutions for real-world applications and train your project, lab and communication skills.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in Chemical Engineering, Chemistry or closely related
Successful completion of “Project work1” project module M.Sc. and an Organic Chemistry (OC) module (or equivalent).
Basic knowledge of organic chemistry or polymer chemistry is required for successful participation in this course.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Regular and active participation in the seminar sessions

- Regular participation in and documented completion of the laboratory/practical work, including adherence to EHS/safety rules
- Timely submission of required project documentation (e.g. lab protocols, interim reports, reflection notes)
- Successful completion of the **“final project presentation**”, which is assessed according to a **grading rubric** presented and agreed upon **in the first seminar session**
- **The entire process is assessed**: from project planning, safety management, literature research and experimental design, through safe and systematic execution, data analysis and sustainability/EHS reflection, up to the final presentation.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Project presentation (group or individual presentation, approx. 20–30 minutes per group; exact duration as specified in the syllabus)
Assessment mode: **The grade is based on the complete project process** and its documentation, including:

- definition of objectives and project planning
- literature research and choice of methods
- experimental design and execution (including EHS/safety compliance)
- data analysis and interpretation
- integration of sustainability and SDG aspects
- teamwork and project management
- quality of the final oral presentation and supporting materials

Assessment follows a grading rubric (evaluation table) with transparent criteria and weightings, which is presented to the students in the first seminar session. This rubric forms the binding basis for grading.

6.4 Requirements for admission to examination

- Enrolment in one of the listed study programmes
- Registration for the examination via myFH-Portal within the specified deadline
- Regular participation in the seminar and laboratory sessions in accordance with the attendance rules
- Demonstrable participation in laboratory work and compliance with EHS/safety regulations (e.g. signed lab protocols, completed safety briefing)

- Submission of all mandatory interim and final documents as specified in the syllabus
- Confirmation by the module coordinator that the project status allows for a final presentation

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr. Stephanie Düttmann

7.3 Professors (optional)

Prof. Dr. Stephanie Düttmann

7.4 Maximum number of participants (optional)

12

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

The practical course takes place in the Laboratory for Polymer Chemistry and Plastics Technologies and is organised by the students themselves in consultation & agreement with the laboratory staff (e.g. Frau Wiemeler, Herr Brand, Herr Marschner, Herr Althoff). Compliance with all lab-specific EHS and safety regulations is mandatory.
Students are welcome to propose their own topics related to plastics/polymers, especially with a strong link to sustainability (SDGs), EHS/safety and industrial relevance. These topics can be integrated into the project portfolio in consultation with Prof. Düttmann.

1	**1.1 Title of module (GER / ENG)** Analytic of Plastics and Polymers	**1.2 Short description (optional)** APP	**1.3 Module code** (from HIS-POS) **CIW.2.0009.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Materials Science and Engineering	WPf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*4*	60		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students will know how to deformulate and characterize a complex polymer additive mixture. They will be familiar with different extraction, chromatographic separation and analytical characterization techniques applied in the field of instrumental polymer analytics.

5.2 Course content

Thermal characterization
Differential thermal analysis (DTA), differential thermal gravimetry, differential scanning calorimetry, application in the field of ceramics and polymers

Characterization of plastics
Plastic formulations and the rule of additives, deformulation principles, sample preparation, extraction strategies, conventional extraction technologies (liquid-solid extraction, sonification, soxhlet, soxtec, soxtherm), high pressure solvent extraction methods (supercritical fluid extraction, microwave technology, microwave assisted extraction, pressurized fluid extraction), methodological comparison of extraction methods, polymer/additive dissolution methods, strategies for hig molecular weight or insoluble additives

Chromatographic separation techniques applied in analytics of polymer additives
GC, HTGC, Headspace, LC, TLC

Polymer additive analysis by spectroscopic and mass spectrometric methods
Instrumentation and applicationsulsions.t has to write experimental reports and is to give an oral presentation of the experiments performed.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelor degree in Applied Chemistry or Chemical Engineering, Chemistry or closely related

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Proof of lab work and pass the exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Written exam (180 minutes) or oral examination

6.4 Requirements for admission to examination
Enrollment in the programme, registration for examination (via myFH-Portal)
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal)

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr. Martin Kreyenschmidt

7.3 Professors (optional)
Prof. Dr. Martin Kreyenschmidt

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Literature: Recommendations are given at the beginning of the lecture.

1	**1.1 Title of module (GER / ENG)** Anlagensicherheit	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0011.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung / Lectures	2	30	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab Course	2	30		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3*	45		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*4*	60		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Die Studierenden sind in der Lage, typische sicherheitstechnische Fragestellungen in der Planung und beim Betrieb von Chemieanlagen alleine und im Team zu bearbeiten und bei der Erstellung von Sicherheitskonzepten und Sicherheitsberichten mitzuwirken.
Praktikum: Die Studierenden können ein Reaktionskalorimeter bedienen, die Flammpunktbestimmung sowie eine DSC-Messung planen, durchführen und die gewonnenen Daten kritisch auswerten.

5.2 Course content

Einführung in die Sicherheitstechnik anhand von Fallbeispielen (Störfälle); Hauptgefahrenquellen; Akteure und Rechtsgrundlagen der Anlagensicherheit in Deutschland und Europa;
Pflichten der Hersteller und Betreiber verfahrenstechnischer Anlagen; produkt- und betriebsbezogene Sicherheitsanforderungen;
Bedeutung und Ermittlung sicherheitstechnischer Kenngrößen; Grundlagen des Brand- und Explosionsschutzes; Beurteilung von Explosionsgefahren und Ex-Schutzmaßnahmen, Erstellung eines Ex-Schutz-Dokuments;

Beschreibung von Stoff- und Energiefreisetzungen und Beurteilung der Auswirkungen (Quellstärke, Ausbreitungsmodelle, Beurteilungswerte);
Methoden der Sicherheitsanalyse, Gefahrenidentifikation und Risikobewertung; PAAG-Verfahren;
Prinzipien der sicherheitsgerechten Gestaltung;
Behandlung sicherheitstechnischer Fragestellungen im Rahmen von Genehmigungsverfahren nach dem BImSchG; Besonderheiten bei Anlagen, die der Störfall-Verordnung unterliegen

Praktikum:
Planung, Durchführung und Auswertung der Versuche zur Reaktionskalorimetrie, Flammpunktbestimmung sowie ggf. Differenz-Kalorimetrie (Flammpunktbestimmung eines Zweistoffgemisches in Abhängigkeit von der Zusammensetzung; Reaktionswärme und Wärmefreisetzungsrate einer Reaktion in Abhängigkeit von den Anfangsbedingungen - z. B. Konzentration, Lösemittel, Anfangstemperatur, Katalysator, Inhibitor - und Übertragung auf eine Reaktion im Satzreaktor sowie sicherheitstechnische Auslegung des Satzreaktors; Untersuchung eines Produktes mittels DSC).

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelorabschluss in Chemie, Chemieingenieurwesen oder ähnlicher Fachrichtung

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Bestehen der Prüfung, Praktikumsprotokolle akzeptiert.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Schriftliche (120 Minuten) oder mündliche (30 – 45 Minuten) Prüfung

6.4 Requirements for admission to examination
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal)

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☐ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr. Thomas Schupp / Prof. Dr.-Ing. Moritz Venschott

7.3 Professors (optional)
Prof. Dr.-Ing. Ulrich Seifert

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Literatur:
Vorlesungsbegleitende Unterlagen als PDF;
Statuspapier „Quellltermberechnung bei störungsbedingten Stoff- und Energiefreisetzungen in der Prozessindustrie – Methodenübersicht und industrielle Anwendung“, ProcessNet, 2014, http://www.processnet.de/quellterm.html
Hauptmanns, U.: Prozess- und Anlagensicherheit, Springer Vieweg, 2013;

Mannan, S. (ed.): Lees' Loss Prevention in the Process Industries, Butterworth Heinemann, 2004;
Ullmann's Encyclopedia of Industrial Chemistry, Plant and Process Safety, Wiley, 2015;
Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA): Themenbereich „Anlagen- und Betriebssicherheit", http://www.baua.de/de/Themen-von-A-Z/Anlagen-und-Betriebssicherheit/Anlagen-und-Betriebssicherheit.html

1	**1.1 Title of module (GER / ENG)** Applied Process Development	**1.2 Short description (optional)** APD	**1.3 Module code** (from HIS-POS) **CIW.2.0065.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Materials Science and Engineering	WPf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.
	Master Großer Wahlbereich TECST	WPf	1./3.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	2	30	**180**	**6**
	Übung / Exercise	2	30		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 4	Sum contact hours in hrs. 60		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*8*	120		
	Sum	**8**	Sum self-study in hrs 120		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

- Students know about the importance of recycle economy and the impact of linear process chains.
- Students are able to develop technical processes, or solutions addressed to recycling, CO_2-savings or generating renewable energy and can use the current tools.
- Students can calculate mass, heat and/or energy balances for self-developed or given processes.
- Students can make specific calculations for Unit Operations.
- Students can estimate and calculate the financial invest and running expenses for a process on a pilot plant scale.
- Students are able to identify given obstacle to implement a process/pilot plant.
- Students can present their solutions to the given problem in terms of technical and financial point of view as well as the feasibility and credible time management.

5.2 Course content

a) Introduction:
Overview of recycling, CO_2-savings and renewable energy systems

b) Process develoment:

Theoretical process examples on a pilot plant scale (e.g. 100l brewery system)

c) Process flow diagrams:
Design PI and other chemical process diagrams for given and/or selected processes

d) Balances:
Mass, heat and/or energy balances for given and/or selected processes
Optional LCA analyses of given and/or selected processes

e) Unit Operations:
Calculate Unit Operations of selected processes

f) Finance:
Calculating investment and running cost of selected and/or given processes
Identification of fundings and discussion to accumulate money for selected and/or given processes

g) Implementation barriers:
Identify structural, social and financial barriers making implementation of selected and/or given pilot plants complicated

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelor degree in engineering or similar

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Give all mandatory presentations, pass the exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Presentation of a developed process + written report (70%).
Commitment and presentations in the seminar (30%)

6.4 Requirements for admission to examination
Participation (> 80%) in the seminar

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr.-Ing. Samir Salameh

7.3 Professors (optional)
Prof. Dr.-Ing. Samir Salameh

7.4 Maximum number of participants (optional)
20

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
All details will be discussed in the lecture

1	1.1 Title of module (GER / ENG)	1.2 Short description (optional)	1.3 Module code (from HIS-POS)
	Bioprocess Engineering		**CIW.2.0014.0.M***
2	2.1 Cycle of module: ☐ each summer semester, ☒ each winter semester other cycle, namely:	2.2 Duration of module ☒ 1 semester ☐ 2 semesters	
3	3.1 Module offered in the following study programme(s):	3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)	3.3 Recommended semester:
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.
	M.Sc. Biomedizinische Technik	WPf	1./3.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method (1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours (sum contact hours and self-study in hrs.)	Workload in total: ECTS (credit points) (generally 30 hrs. = 1 credit point; only full numbers allowed)
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	2	30		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*6*	90		
	Sum	**6**	Sum self-study in hrs 90		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Based on the biochemical kinetics the students can design enzymatic reactors and fermentation processes. For intracellular and extracellular products they can design the appropriate downstream processing considering typical unit operations for bioprocess separations.
After completion of the lab training they can design experiments for determination of important metabolic parameters and oxygen transfer and uptake characteristics.

5.2 Course content

A) Introduction and advantages of bioprocesses, growth kinetics, enzymes and enzyme kinetics, immobilization of microorganisms and enzymes, design of bioreactors and bioprocesses, sterilization,
B) Cell disruption and bioseparations:
removal of biomass (filtration, microfiltration and centrifugation)
enrichment of the target substances (ultrafiltration, dialysis, precipitation, adsorption)
purification by chromatography

Lab:
With lab experiments and computer simulations the students will gain know how in optimal and safe process control. They will apply their skills in a bioprocess design project done by a group of three to four students.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelor degree in chemical engineering or similar programs

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Acceptance of lab and project reports and successfully passed exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Written reports and oral presentations for lab and project,
written (120 minutes) or oral exam (30-45 minutes).

6.4 Requirements for admission to examination
Enroled in the program Chemical Engineering or Industrial Engineering, timely registration for the exam (by myFH-Portal).

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☐ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr.-Ing. Mirjam Altendorfner

7.3 Professors (optional)
Dr.-Ing. Aylin Erkmen

7.4 Maximum number of participants (optional)
20

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Literature:
Lecture script (PDF); additional Literature:
Chmiel, H.; Bioprozesstechnik, 3. Auflage, Spektrum Akademischer Verlag 2011
Storhas, W.; Bioverfahrensentwicklung, Wiley VCH 2003
Hass, V.C.; Pörtner, R.; Praxis der Bioprozesstechnik, Spektrum Akademischer Verlag 2009
Shuler, M.L.; Kargi, F.; DeLisa, M.; Bioprocess Engineering: Basic Concepts, Pearson Education Inc. 2017
Doran, P.M.; Bioprocess Engineering Principles, Academic Press 2013

1	**1.1 Title of module (GER / ENG)** Chemical Technology of Materials	**1.2 Short description (optional)** CToM	**1.3 Module code** (from HIS-POS) **CIW.2.0016.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Materials Science and Engineering	WPf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.
	M.Sc. Photonics	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3*	45		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*4*	60		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

After complete the module, students can classify phenomena that can be traced back to electronic structures of solids. The students are able to reflect on basic principles such as solid state, ceramic, powder and colloid chemistry in relation to technical applications and to analyse them from the chemist's point of view. By participating in a lab course the theoretical knowledge is put into practice and students are able to carry out projects and tasks based on current R&D issues of materials independently.

5.2 Course content

Specifical topic of materials science

Free electron approach:
Time-independent Schrödinger-equation for stationary systems, Eigenvalue, Eigenfunction, k-Vector, density of states in metals

Tight binding approach:

Bloch-functions of one-, two- and threedimensional systems, density of states, Brillouin-zones, band structure

Semiconductors:
Boltzmann-, Fermi-Dirac-statistics, conductivity, band structures in semiconductors, LED's, solar cells, semiconductor lasers

Interfaces:
Thermodynamic background, vapour pressure of small droplets, mono- and polydispersed systems, methods to prepare monodispersed dispersions, kinetic vs. steric stabilization, Ostwald-ripening, hydrophobic interaction, lyotropic mesophases, rheology (viscosity, measurement, applications)

Ceramic processes:
Green body processing, raw materials, thermal processe (Sintering: transport, fluxes, gas phases)

Lab:
Practical tasks / projects within current R&D work on materials of the department, to be concluded with a written report and presentation of the accomplishments

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Topics of Inorganic and Physical Chemistry from a B.Sc.-programme in Chemistry, Chemical Engineeringor similar course programmmes

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Praktikumsnachweis durch schriftlichen Bericht und Vortrag, Literaturrecherche und Bestehen der Prüfung
Written report and oral presentation on the laboratory work conducted, literature review and successful exam

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Written exam (180 minutes) or oral examination

6.4 Requirements for admission to examination
Enrollment in the programme, registration for examination (via myFH-Portal)
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal)

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr. Thomas Jüstel

7.3 Professors (optional)
Prof. Dr. Thomas Jüstel, Prof. Dr. Joachim Breternitz

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Literature:

Textbooks on Materials Science, Ceramics and Physical Chemistry. Transcripts of the lectures (partially) and additional materials are made available on the net.

1	**1.1 Title of module (GER / ENG)** Chromatographic Methods – Basics, Instrumentation and Applications	**1.2 Short description (optional)** CM	**1.3 Module code** (from HIS-POS) **CIW.2.0017.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	2	30	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	2	30		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*4*	60		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students are familiar with the chromatographic methods, their applications and the corresponding equipment technology. They are able to plan, perform and evaluate complex analyses.

5.2 Course content

<u>Fundamentals of chromatography</u>

Description of the chromatographic separation process, band broadening and column efficiency, parameters for optimization of chromatographic separation, integration of peaks.

<u>Gas chromatography</u>

- Thermodynamic fundamentals
- sample injection, special injectors (e.g. PTV, On-column) and sample introduction systems like headspace, SPME, thermal desorption and pyrolysis

- columns and stationary phase, fast GC and 2D techniques (backflush, heartcut and comprehensive 2D GC)
- special detectors, GC/MS coupling (basics, mass spectrometer, evaluation of spectra).

HPLC

- Characterization of stationary phases, characterization of mobile phase (polarity/selectivity), characterization of column efficiency
- Development of isocratic methods, gradient elution,
- UHPLC, HPLC/MS coupling
- Special HPLC techniques like HILIC, ion pair Chromatography, ion (exchange) Chromatography, affinity chromatography and supercritical fluid chromatography are discussed in terms of separation mechanism, stationary and mobile phases, device design and applications.

Lab

During the laboratory course, the students work on current tasks from the laboratory or work on their own topics after consultation.
Students write an experimental protocol and present their results in the form of an oral presentation.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

Identification of unknown compounds, separation and quantification: chromatographic methods are versatile and indispensable tools in various scientific, industrial, and regulatory fields, providing crucial information for analysis, purification, and quality assurance.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in Applied Chemistry or Chemical Engineering, Chemistry or closely related.
For safety reasons, good laboratory skills are a prerequisite for participation in the practical laboratory course for this module. (Laboratory skills can be acquired beforehand in the module “Project Work 1 - Laboratory / Laboratory Internship”).

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Written report on laboratory experiments, oral presentation of the results and successful examination.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Written exam (120 minutes) or oral examination

6.4 Requirements for admission to examination

Enrollment in the programme, registration for examination (via myFH-Portal)
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal)

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr. Klaus Schlitter

7.3 Professors (optional)

Prof. Dr. Klaus Schlitter

7.4 Maximum number of participants (optional)

16

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Literatur: Lecture manuscript, literature will be announced in the lecture.

1	**1.1 Title of module (GER / ENG)** Hazardous Substances: Regulations and Risks	**1.2 Short description (optional)** HS	**1.3 Module code** (from HIS-POS) **CIW.2.0067.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Materials Science and Engineering	WPf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	2	30	**180**	**6**
	Übung / Exercise	2	30		
	Praktikum / Lab course	2	30		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3*	45		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**6**	Sum self-study in hrs 90		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Participants will learn and understand the requirements for placing Hazardous Substances on the European Union market. They will understand the classification and labelling of substances according to their physical-chemical, toxicological and ecotoxicological properties. Students will learn how to perform and interpret tests for ecotoxicity. Students will be able to explain the basic concepts of toxicological action. They will be familiar with illustrative examples of selected toxic substances, their hazards and first aid.

5.2 Course content

- Registration, Evaluation and Authorization of Chemicals (1907/2006/EU)
- classification, labelling and packaging of substances and mixtures (1272/2008/EU)
- basics in toxicology and ecotoxicology
- regulations concerning worker protection with respect to hazardous substances
- regulations concerning marketing of hazardous substances
- exposure assessment (principles of monitoring; IT tools, p.e. Advanced REACh Tool (ART), ECETOC TRA or Chesar)
- properties of selected hazardous substances

Lab:
Practical ecotoxicological experiments are to be performed.

Optional add-on, in German language only: bei erfolgreicher Teilnahme am Modul „Hazardous Substances“ können Teilnehmer – unabhängig von ihrer Nationalität – eine schriftliche Prüfung zur eingeschränkten Sachkunde nach §11 der Chemikalienverbotsverordnung ablegen. Die Prüfungsbedingungen orientieren sich an der jeweils gültigen Fassung der „Bekanntmachung zum Sachkundenachweis gemäß Chemikalienverbotsverordnung“ des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit. Die Fragen werden der 30 Tage vor Klausurtermin aktuellsten Fassung des Fragenkataloges, Teil I und II „Gemeinsamer Fragenkatalog der Länder (GFK) für die Sachkundeprüfung nach §11 Chemikalienverbotsverordnung“ entnommen. Von den jeweils 20 Fragen müssen innerhalb 60 Minuten jeweils mindestens 11 Fragen richtig beantwortet werden. Das Bestehen dieser Zusatzprüfung hat weder eine Wirkung auf die Vergabe oder Anzahl der Leistungspunkte noch auf die Gesamtnote des Moduls, führt aber zum Erwerb der eingeschränkten Sachkunde nach ChemikalienverbotsVO. Diese Zusatzprüfung kann nur in Deutsch abgelegt werden.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

Students learn the principles of hazards posed by chemicals, understand basic principles of toxic mechanisms and critical physical-chemical properties. Based on corresponding data, students can classify and label hazardous substances and understand the preconditions and restrictions for placing hazardous substances on the EU market. They are able to perform risk evaluations.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in Chemical Engineering, Chemistry or closely related. Good basic knowledge in chemistry.
It is strongly recommended to have passed the module “Biochemistry” first. Students have good chemical laboratory skills.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Completion of lab experiments and exam passed.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Oral (30 min) or written examination (120 minutes) or homework.

6.4 Requirements for admission to examination

Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal).
Enrollment in the program, register for the examination (via myFH-Portal)

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr. Thomas Schupp

7.3 Professors (optional)

Prof. Dr. Thomas Schupp

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Hazardous substances: Risks and Regulations (https://www.degruyter.com/view/title/562282?tab_body=toc)
https://echa.europa.eu/de/regulations/reach; look up “guidance“ and “regulations”, p. e. Regulation (EC) No 1107/2009, 528/2012, 2009/128, 1005/2009, 1272/2008, 1907/2006, Directive 2004/37/EC, 98/24/EC,
Optional ad-on: u. a. Nationale Implementierung der EU-Richtlinien und Verordnungen, (German add-on): Chemikaliengesetz und nachfolgende Verordnungen wie z. B. GefahrstoffVO, ChemikalienverbotsVO, TRGS 200, 220, 440, 900, 905,...)

1	**1.1 Title of module (GER / ENG)** Optical and Electrical Characterization of Materials	**1.2 Short description (optional)** OEC	**1.3 Module code** (from HIS-POS) **CIW.2.0038.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Materials Science and Engineering	WPf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*5*	75		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*2*	30		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students will be able to characterize inorganic materials regarding their optical and electrical properties. Moreover, they will be able to perform basic calculations necessary for the characterization of these materials.

5.2 Course content

Absorption and luminescence spectroscopy on single crystalline, ceramic and powder materials
Determination of absorption and extinction coefficients, measurement of absorption, reflection, excitation and emission spectra. Time resolved spectroscopy, temperature dependent spectroscopy, VUV spectroscopy, Kubelka-Munk function, instrumental aspects, evaluation under calorimetric point of views, quantum efficiency determination, flicker measurements, saturation, actinometry.

Electric and dielectric properties
Two- and four-point method, excess conductivity on surfaces, application in the sensor field, types of electrodes and charge carrier species, alternating current conductivity, impedance spectroscopy, definition

of the relative dielectric constant and refractive index, polarization and mechanisms of polarization, relaxation times and frequency dependencies, electric susceptibility

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in Applied Chemistry or Chemical Engineering, Chemistry or closely related

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Proof of lab work and pass the exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Quality of seminar contribution (Optical Characterization); criteria to be announced at course start (10% of grade points) + Quality of seminar contribution (Electrical Characterization); criteria to be announced at course start (10% of grade points)
Written exam (180 minutes) or oral examination (80% of grade points)

6.4 Requirements for admission to examination

Enrollment in the programme, registration for examination (via myFH-Portal).
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr. Thomas Jüstel

7.3 Professors (optional)

Prof. Dr. Thomas Jüstel, Prof. Dr. Steffen Neitzel-Grieshammer

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Literature:
Book Recommendations are given at the beginning of the lecture.
Lecture notes can be downloaded.

1	**1.1 Title of module (GER / ENG)** Particle Technology	**1.2 Short description (optional)** PT	**1.3 Module code** (from HIS-POS) **CIW.2.0062.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	3.
	M.Sc. Materials Science and Engineering	WPf	3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	2	30	**180**	**6**
	Übung / Exercise	2	30		
	Praktikum / Lab course	2	30		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*4*	60		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*2*	30		
	Sum	**6**	Sum self-study in hrs 90		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

- Students know how to describe disperse systems and can discuss and interpret important unit operations related to Particle Technology.
- Different particular systems can be compared by the students based on suitable size measures and other properties.
- Students can apply the basic knowledge of particle technology to relevant technical problems and judge the relevant unit operations.
- Furthermore, they are able to solve the discussed problems by using computational tools such as Python or others.

5.2 Course content

a) Introduction into Particle Technology:
Explanation of the terms, concepts, industrial and ecological relevance of Particle Technology.

b) Particle size distribution:

Explanation of the concepts of size distributions, important statistical measures and how determine the size distribution (analytical and based on Python). Working with distributed values.

c) Particles in a fluid:
Describe and predict the behaviour of single particles in a fluid, examine fluid flow through a packed bed (e. g. transport, settling), discussing the fundamentals and applications of a fluidized bed reactor.

d) Separation of particles:
Overview over relevant techniques with a focus on cyclones and filtration. Highlight the relevance for different current technical problems and processes.

e) Particle size reduction:
Introducing particle fracture mechanisms and their application in modern processes.

f) Agglomeration:
Introducing forces acting between particles and their basic concepts, technical importance of agglomeration and the effect on selected processes.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelor degree in Chemical Engineering, Chemistry or closely related

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Pass lab exercises (written report) and exam (oral or written)
Praktikumsnachweis (schriftlicher Bericht) und Bestehen der Prüfung

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Written tasks and / or oral presentations on practical experiments or given data.
Written exam (90 minutes) or oral exam

6.4 Requirements for admission to examination
Regular participation in lab exercises and recognition of the associated report.
Enrolment in the programme, register for the examination (via myFH-Portal).
Regelmäßige Teilnahme am Praktikum und Anerkennung der zugehörigen Ausarbeitungen.

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr.-Ing. Samir Salameh

7.3 Professors (optional)
Prof. Dr.-Ing. Samir Salameh

7.4 Maximum number of participants (optional)
26

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Manuscript in the lecture
GitHub scripts

Introduction to Particle Technology Martin Rhodes
Wiley 2nd edition 2008

More recommendations are given in the lecture

1	**1.1 Title of module (GER / ENG)** Project Management	**1.2 Short description (optional)** PM	**1.3 Module code** (from HIS-POS) **CIW.2.0042.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Materials Science and Engineering	WPf	1./3.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total **Workload in hours** sum contact hours and self-study in hrs.	**ECTS (credit points)** generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Seminar	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*4*	60		
	Teilnahme am Seminar Seminar contribution	*3*	45		
	Sum	**7**	Sum self-study in hrs 105		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Students are able to plan small and medium projects independently. They can apply the scientific, economic and electronic tools of project management. The students deepen and verify their obtained knowledge in a simulated IT-project and by means of the simulation game "TOPSIM – Startup".

5.2 Course content

Principles and basics of project management in enterprises:

Seminar part 1
Business Administration: legal contracts, procurement, production, marketing, organisation, investment profitability, financing, constitiutive decisions, profit & loss schemes

Seminar part 2
Project Management: project initialisation, project organisation, project team, project structure, Gantt and network planning techniques, resource and cost planning, monitoring and reporting, project change management

Software training on MS Project
Initialising an IT-project, preparing a quotation, realisation of the project considering most of the topics mentioned before under Business Administration and Project Management

Seminar Business Plan
Business Plan simulation: “TOPSIM – Startup”

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelor degree in Physics, Physics Engineering, Chemistry, Applied Chemistry, Chemical Engineering, Materials Science, or closely related

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

- Successful participation in the Project Management-Software training
- Successful participation in the simulation game “TOPSIM – Startup”
- Passing the exam

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Electronic exam (75 min) or written exam (120 min) or oral exam (45 min) (contribution 60%).
Seminar evaluation of the business plan “TOPSIM – Startup” (contribution 40%).
The seminar evaluation is adapted by a peer-review process.

6.4 Requirements for admission to examination
Enrolment in the programme, register for the examination (via myFH-Portal), successful participation in “TOPSIM – Startup”

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr.-Ing. Joachim Guderian

7.3 Professors (optional)
Prof. Dr.-Ing. Joachim Guderian

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Literature is recommended in the lecture

1	**1.1 Title of module (GER / ENG)** Sustainable and Environmental Engineering	**1.2 Short description (optional)** SEE	**1.3 Module code** (from HIS-POS) **CIW.2.0056.0.M* (6 CP)** **CIW.2.0057.0.M* (3 CP)**
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	2 (2)	30 (30)	**180 (90)**	**6 (3)**
	Übung / Exercise	1 (1)	15 (15)		
	Praktikum / Lab course	2 (0)	30 (0)		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5 (3)	Sum contact hours in hrs. 75 (45)		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*1 (1)*	15 (15)		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*4 (0)*	60 (0)		
	Prüfungsvorbereitung Preparation for exam	*2 (2)*	30 (30)		
	Sum	**7 (3)**	Sum self-study in hrs 105 (45)		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

- mutual acceptations of the challenges of development of a greener chemistry/chemical processes,
- identify sustainable social, economic and environmental principles and associate standard processes,
- understand and apply the hierarchy of eliminating, replacing, minimizing the environmental hazards,
- identify and assess opportunities for improving the greenness of processes (e.g. solvent recovery, fermentation, crystallization,)
- understand the concepts of conversation of mass and energy in the context of green engineering metrics, draw and understand process flow diagrams
- identify the key factor that effects the selection of reactors/separators (unit operations) and their implication on green engineering
- Understand the concept/methods of sustainability evaluation of e.g. waste and small wastewater treatments systems
- Identify the opportunities for improvements through LCA/GHG protocols

- Identify the difference between greenwashing and environments declarations
- Understand and apply the techniques to evaluate the life cycle impact of energy requirements and energy choices on environmental foot print
- Impacts of waste and waste treatments and meaning of environmental fate and effects
- Identify some emerging materials and their dis-, advantages from module perspectives
- Understand the role and barriers that prevent the use of renewable materials and energy

5.2 Course content

- Basic concepts, outlines, policies and principles of environmental technology at local, national and international level, Raw materials and Energy-Introduction and overview of the most important global environmental problems,
- Emission sources: pollutants of combustion, pollutants from power plants, transport, industry, agriculture and waste disposal
- Movement toward more sustainable processes and chemistry, design greener production, best available technology (BAT), basic process engineering for renewable materials and energy, waste recycling and energy potential of waste, Primary measures and separation process on selected examples.
- Mass and Energy balances, Process draw diagrams, methods/protocols for evaluation of process sustainability LCA/GHG
- Student short project papers: on current problems of process and environmental technology

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in Chemical or Construction Engineering, Chemistry, or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

For 3 CP: Pass the exam (homework + written/oral exam)
For 6 CP: Pass the exam (homework + written/oral exam). Participation in the Intership (Lab course).

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

30%: homework (Prof. Schupp: environmental chemistry)
70%: written exam (120 min) or oral exam (Prof. Wäsche: sustainable engineering)
The points achieved in the homework can be credited towards the written or oral examination up to the end of lectures in the following winter term.

6.4 Requirements for admission to examination

Enrollment in the program, finalization of seminar (10-15 pages) only for 6 ETCS, register for the examination (via myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr.-Ing. Andreas Wäsche

7.3 Professors (optional) Prof. Dr.-Ing. Andreas Wäsche, Prof. Dr. Thomas Schupp
7.4 Maximum number of participants (optional) 20. The number of participants in the internship is limited to 20 people as planned.
7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.) C. Jiménez-González, et al.: Green Chemistry and Engineering. (2011) J. Wiley & sons Inc. Hoboken A. Koltuniewicz; Sustainable Process Engineering. (2014) De Gruyter, Berlin Bosten Ullmann's Renewable Resources. (2013) Wiley-VCH Verlag GmbH & Co. KGaA.

1	**1.1 Title of module (GER / ENG)** Technology of Coatings	**1.2 Short description (optional)** ToC	**1.3 Module code** (from HIS-POS) **CIW.2.0046.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☒ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	1./3.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	1./3.
	M.Sc. Materials Science and Engineering	WPf	1./3.
	M.Sc. Wirtschaftsingenieurwesen	WPf	1./3.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*4*	60		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*1*	15		
	Prüfungsvorbereitung	*2*	30		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students can explain the basic components for coating materials including paints, colorants, pigments, dyes, additives and polymer binders and the definitions of relevant technical terms. They can assess fundamental physicochemical properties and phenomena of surfaces to describe properties of coatings. They can discuss the development of paints up to typical complete four-layer paint formulations used in automotive industry. They can point out other important applications of coating techniques, e.g. for constructions, in medicine, optics or electronics and their processing techniques. They can distinguish between different coating processes and characterization methods and can identify their advantages and applicability. This includes to evaluate ecological aspects of automotive paints and processes used today.

The lectures will be supported by practical exercises performing calculation examples and laboratory experiments on wettability, surface energy and and colorimetry measurements.

5.2 Course content

1. Introduction
Definitions, historical development, economic importance
2. Physicochemical Basics of Coating Technology
Wettability, surface tension, adhesion, colloids, interaction of light and matter
3. Paint Chemistry: Components and Formulations
Binders, resins, colorants, additives, solvents
4.Coating Deposition Processes
Surface pretreatment, spray coating, deposition from solution, electrocoating, chemical vapor deposition
5. Quality Tests
Surface analysis methods, color and appearance, mechanical tests
6. Application Examples
Automotive, protective, functional, optic, self-repair and thermal barrier coatings

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in chemistry, chemical engineering, physical engineering or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Pass the exam, participation to excursion, testified reports for practical exercises.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Written exam (120 min) or oral exam (45 min).

6.4 Requirements for admission to examination

Enrollment in the module, registration for examination (via myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**

☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr. Michael Schäferling

7.3 Professors (optional)

Prof. Dr. Michael Schäferling

7.4 Maximum number of participants (optional)

28

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Literature:
-H-J.Streitberger; K-F.Dössel: Automotive Paints and Coatings; Wiley-VCH; Weinheim; 2008
-A.Goldschmidt; H-J.Streitberger: Lackiertechnik, Vincentz-Verlag
-T.Brock; M.Groteklaes; P. Mischke: Lehrbuch der Lacktechnologie, 2. Auflage, Vincentz-Verlag

Script and lecture slides

1	**1.1 Title of module (GER / ENG)** Advanced Analytical Chemistry	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0003.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*4*	60		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The lectures, exercises and the practical training enable students to work out analytical problems and to propose solutions in the following fields:
Analysis of water. Methods for determining impurities in drinking water and pollutants in sewage.
Analysis of fats and fatty oils. Techniques for the determination of fatty acids and of the components of the unsaponifiable matter.
Petroleum analysis. Methods for analysing the components in crude oil and its distillation products.
The students are able to evaluate analytical data.

5.2 Course content

Syllabus:
Water Analysis
Introduction: Hydrologic cycle, water resources, water treatment.
Analysis of drinking water
Techniques of sampling.

total parameters: coloring, temperature, electrical conductivity, pH, redox potential, settleable substances, oxygen.
Inorganic parameters: chloride, sulfate, nitrate, nitrite, phosphate, carbonate, fluoride, cyanide. Lithium, sodium, potassium, magnesium, calcium, iron, manganese, cadmium, mercury, lead, arsenic, zinc.
Analysis of sewage
Sampling.
Organic parameters: total organic carbon (TOC),
chemical oxygen demand
(COD), biochemical oxygen demand (BOD), extractable organic
halogen compounds (EOX), adsorbable organic halogen compounds
(AOX). hydrocarbons,
polycyclic aromatic hydrocarbons (PAH), pesticides, phenols, volatile
organic compounds (VOC).

Analysis of Fats and Fatty Oils.
Introduction: occurance and properties, structure of triglycerides, saponification, frequency of saturated and unsaturated fatty acids in plant, animal and marine fats. Unsaponifiable matter, carotinoids, hydrocarbons, sterols and tocopherols.
Analyses of fatty acids in triglycerides, methods of derivatization, gas chromatography.
Determination of the compounds in the unsaponifiable matter. Analysis of the carotines by UV-spectroscopy and by HPLC. Analysis of sterols by GC after derivatisation. Determination of tocopherols by HPLC.
Methods for identifying fats or a fatty oil.

Petroleum analysis.
Introduction: Occurance of mineral oil. Chemical composition and physical properties. Petroleum processing.
Analysis of crude oil: distillation residue, water, sulfur, ash, salt.
Analysis of liquified petroleum gas (LPG): corrosiveness to copper, test on hydrogen sulfide, total sulfur, oily residue, antiknock property, vapour pressure, components in commercial LPG.
Petrol: distillation range, sulfur, flash point, oxygen contaning compounds, gum Detailed synopsis – Inhaltsangabe: benzene, corrosiveness to copper, lead, oxydation stability, antiknock property.
Diesel fuel and heating oil: Cloudpoint, ash, flashpoint, density, distillation range, corrosiveness to copper, oxydation stability, cold filtet plugging point (CFPP). cetane number. Sulfur, furfural, water, aromatics.
Fluorecent indicator adsorption (FIA), carbon residue. Caloric value, lubricity, viscosity.
Lubrication oils: ash, carbon residue, viscosity.
Distillation residue: needle penetration, softening point, viscosity.

Evaluation of analytical data.
Significant figures, accuracy and precision, determinate and indeterminate errors, standard deviation, confidence intervall.
F-test, Student-t-test, outliers, calibration function, detection limit.

Practical
Analysis of the anions in drinking water by ion chromatography.
Determination of the total organic carbon (TOC) in sewage.

Analyses of fatty acids in palm oil by GC after derivatisation with trimethylsulfoniumhydroxide (TMSH).

Determination of tocopherols in palm oil by HPLC.
Distallation range of petrol by GC.
Determination of aromatics in Diesel fuel by HPLC.
→ details can be found in course syllabus, recommended study plan etc.

	5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.
6	**6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)* Bachelor degree in Chemical Engineering, Chemistry or closely related.
	6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation) Proof of lab work and pass the exam. Praktikumsnachweis und Bestehen der Prüfung.
	6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes) Written tasks and / or oral presentations on practical experiments. Written exam (180 min) or oral exam.
	6.4 Requirements for admission to examination Enrollment in the programme, registration for examination (via myFH-Portal). Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal).
	6.5 Weighing of module grade when calculating final grade see examination regulations for aforementioned study programmes (line 3).* *You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.
7	**7.1 Languages used in the module:** ☐**German** ☒ **English** ☐ **others, namely:**
	7.2 Contact person for module: Prof. Dr. Martin Kreyenschmidt
	7.3 Professors (optional) Prof. Dr. Martin Kreyenschmidt
	7.4 Maximum number of participants (optional)
	7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.) Literature: Recommendations are given in the lecture.

1	**1.1 Title of module (GER / ENG)** Advanced Organic Materials	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0054.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Materials Science and Engineering	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	2	30		
	Praktikum / Lab course				
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Work on exercises and seminar tasks, preparation of presentation, preparation for lectures	*5*	75		
	Wrap-up of lectures and preparation for exam	*2*	30		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

After attending this course students can assess which types of organic materials can be applied in current optoelectronic and nano-technologies and how these can replace typical inorganic materials such as metals, semiconductors, glasses or crystals. The students will understand the composition and functionality of different types of organic materials beyond classical polymers including conducting oligomers and polymers, liquid crystals, charge transfer complexes, polyelectrolytes, polymer electrolytes and responsive polymers. Students can recognize current and future application areas of these materials and explain their impact on light emitting devices, flat displays, solar cell or electrode materials, organic transistors and nanotechnology.

On the basis of exercises the students will review their learning progress, discuss examples and new developments from the current literature and compare different technologies.

5.2 Course content

- Intermolecular interactions and self-assembly
- Functional polymers, polyelectrolytes
- Responsive polymers and polymer nanoparticles
- Electrical conducting polymers and oligomers

- Liquid crystals and LCDs
- OLED materials
- Organic photovoltaics
- Organic electronics
- Challenges and future applications

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in chemistry, chemical engineering, physical technology or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Pass the exam, active participation in exercises, presentation on selected topic.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Written exam (120 minutes) or oral exam (45 min).

6.4 Requirements for admission to examination

Enrollment in the module, registration for examination (via myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr. Michael Schäferling

7.3 Professors (optional)

Prof. Dr. Michael Schäferling

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Literature:

- Script

1	**1.1 Title of module (GER / ENG)** Aerosol- and Nanotechnology	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0063.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Materials Science and Engineering	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	2	30	**180**	**6**
	Übung / Exercise	2	30		
	Praktikum / Lab course	2	30		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3*	45		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**6**	Sum self-study in hrs 90		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

- Students know how to describe disperse systems and can discuss and interpret important unit operations related to Aerosol Technology.
- Students have an understanding of relevant measurement techniques in the field of Aerosol- and Nanotechnology. They can discuss the advantages and limits of these systems.
- Students can apply the basic knowledge of Aerosoltechnology to relevant technical and scientific problems and further judge relevant unit operations.
- Students are able to identify relevant scientific work in the field of Aerosol- and Nanotechnology and can independently work out the main findings, used techniques and problems described in these papers.
- Furthermore, they are able to solve the discussed problems by using computational tools such as Python or others.

5.2 Course content

a) Introduction into Aerosol- and Nanotechnology:
Explanation of the terms, concepts, industrial, ecological, and scientific relevance of Aerosol and Nanotechnology.

b) Particle Size Distribution:
Explanation of the concepts of size distributions, important statistical measures and how determine the size distribution (analytical and based on Python). Working with distributed values.

c) Particles in a fluid:
Describe and predict the behaviour of single particles in a fluid. Consider the size aspect for Aerosols.

d) Transport of aerosols:
Main concept how Aerosols move. Considering the Navier-Stokes equation for Aerosols. Introduce the concept of Thermophoresis.

e) Separation of particles:
Overview over relevant techniques with a focus on filtration. Highlight the relevance for different current technical problems and processes.

f) Particle growth and decrease:
Introducing population balances and their application in modern processes.

g) Carbon based nanoparticles:
Discussing the importance of carbon-based nanoparticles, their usage in industry and applications, as well as their synthesis methods.

h) Adhesion forces:
Introducing forces acting between particles and their basic concepts, technical importance of agglomeration and the effect on selected processes.

i) Future topics:
Outlook into the future of Aerosol and Nanotechnology such as for example nanomachines, quantum computer, or nanoparticles in pharmaceutical applications.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in Chemical Engineering, Chemistry or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Pass lab exercises (written report or presentation), participation in homeworks (oral or written), and exam (oral, written or homework). The exact specifications will be clarified in the lecture. The seminar has compulsary attendance. (>80%)

Praktikumsnachweis (schriftlicher Bericht oder Präsentation), bearbeiten der Hausaufgaben (mündlich oder schriftlich) und Bestehen der Prüfung (mündlich, schriftlich oder als Hausaufgabe). Die genauen Vorgaben werden in der Vorlesung abgeklärt. Das Seminar hat Anwesenheitspflicht (>80%)

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Written tasks and / or oral presentations on practical experiments or given data (20%).
Lab exercises (20%).
Exam (90 minutes) or oral exam or homework (60%).

6.4 Requirements for admission to examination
Regular participation in lab exercises and recognition of the associated report.
Enrolment in the programme, register for the examination (via myFH-Portal).
Regelmäßige Teilnahme am Praktikum und Anerkennung der zugehörigen Ausarbeitungen.

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr.-Ing. Samir Salameh

7.3 Professors (optional)
Prof. Dr.-Ing. Samir Salameh

7.4 Maximum number of participants (optional)
26

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Manuscript in the lecture

GitHub scripts

Smoke, Dust, and Haze Sheldon Friedlander
Oxford University Press 2nd edition 2000

Aerosol Technology: Properties, Behavior, and Measurements of Airborne Particles
William C. Hinds Wiley-Interscience 2022

Transport of Nanoparticles in Gases: Overview and Recent Advances
Lutz Mädler and Sheldon Friedlander, Aerosol and Air Quality Research, 7, 304-342, 2007

More recommendations are given in the lecture

1	**1.1 Title of module (GER / ENG)** Applied Crystallographic Methods	**1.2 Short description (optional)** ACM	**1.3 Module code** (from HIS-POS) **CIW.2.0076.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Materials Science and Engineering	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Seminar	1	15		
	Praktikum / Lab course	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*4*	60		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**7**	Sum self-study in hrs 105		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students acquire a fundamental understanding of the crystalline state and its determination through diffraction experiments. The students get to know diffraction techniques using different rays (X-rays, neutrons, electrons), different sample states (powders, single crystals) and the differences between these techniques. A particular emphasis is put on X-ray diffraction as the most important technique and a deeper understanding of X-ray generation, instrumentation and detection will be learned. Furthermore, the students will gain insight into the practical aspects of measuring and solving crystal structures from X-ray single crystal and/or powder diffraction.

5.2 Course content

1. The crystalline state
- fundamentals of crystallography
- translational symmetries and point symmetries
- space group symmetries
- duality of crystal structure and lattice
- scattering of waves in crystals – the Bragg equation

- The crystallographic phase problem
2. The reciprocal space
- The Ewald construction
- Brillouin-Zone and Wigner-Seitz-cells
- Physical properties in the reciprocal space, e.g. phonons
- Diffraction space vs. Momentum space
3. X-ray diffraction
- generation of X-rays
- instrumentation for single crystal and powder diffractometers
- X-ray detection
- practical aspects of diffraction experiments (*including lab work*)
- documentation of crystallographic information (CIF-Files)
4. Diffraction with further probes
- neutron diffraction
- electron diffraction

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

Understanding the crystalline state is fundamental to understanding applied materials. This module will provide the toolset for measuring and solving crystal structures from diffraction experiments.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in chemistry, chemical engineering, or closely related.
The module Chemical Technology of Materials is recommended in conjunction.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Successful participation in the lab work and passing of the exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Written lab report in the form of a cif file.
Homework assignment, written examination (120 min) or oral examination (30 min).

6.4 Requirements for admission to examination

Participation in the labwork.
Enrollment in the module, registration for examination (via myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr. Joachim Breternitz

7.3 Professors (optional)

Prof. Dr. Joachim Breternitz

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Literature recommendations will be given at the start of the lecture series.

1	**1.1 Title of module (GER / ENG)** Biochemistry	**1.2 Short description (optional)** BC	**1.3 Module code** (from HIS-POS) **CIW.2.0012.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	2	30	**180**	**6**
	Übung / Exercise (online)	1	15		
	Praktikum / Lab course	2	30		
	Seminar	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*4*	60		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*2*	30		
	Sum	**6**	Sum self-study in hrs 90		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Students acquire a solid understanding of the analysis and function of amino acids, proteins, enzyme kinetics, genetic code and selected metabolic pathways. With this knowledge they will be able to develop solutions for biochemistry-based questions in biotechnology, analytical chemistry, pharmacology and medicine and will be able to actively discuss problems in these fields interdisciplinary.

5.2 Course content

Detailed synopsis:
- amino acids (genetically coded amino acids)
- peptides (chemical syntheses, protecting groups, properties)
- proteins (isolation and purification, analysis, structure, properties)
- enzyme kinetics (Michaelis-Menten equation,
different kinds of inhibition, regulation of enzyme activity)
- metabolic pathways
(Glycolysis, citric acid cycle, oxidative phosphorylation)
- basic understanding of RNA, DNA and the genetic code; DNA-Analysis (genetic fingerprint)

Lab:
During the practical experiments are performed which accompany the corresponding lecture.
Each student has to write experimental reports. You will learn to isolate, purify and check the activity of an enzyme, and you will learn how to isolate DNA and how to do a DNA analysis. 10 bonus points on the exam may be granted if the lab report has grade 2.0 or better, and 5 Bonus points if the report is at least grade 3.0.
→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.
The focus of the module is on properties, function, isolation and purification of proteins and enzymes, the genetic code and DNA analysis.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelor degree in Chemical Engineering, Chemistry or closely related. Basics in organic chemistry are applied which are a prerequisite for successful participation in this course. During your Bachelor studies, you have gained at least 6 CP in Organic Chemistry, exclusively!
To be able to participate in the laboratory internship, you can demonstrate good chemical laboratory skills.
Minimum No. of students: 5

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Praktikumsnachweis und Bestehen der Prüfung.
Proof of internship and pass the exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Written exam (120 min) or oral exam (30 min).

6.4 Requirements for admission to examination
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal)
Enrollment in the program, register for the examination (via myFH-Portal)

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr. Thomas Schupp

7.3 Professors (optional)
Prof. Dr. Thomas Schupp

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Fromm / Hargrove: Essentials of Biochemistry; Stryer et al, Biochemistry; Lehninger et al, Biochemistry.

1	**1.1 Title of module (GER / ENG)** Bioinorganic Chemistry	**1.2 Short description (optional)** BIC	**1.3 Module code** (from HIS-POS) **CIW.2.0013.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 **Workload**

				Workload in total	
	Teaching methods	**Weekly teaching hours ("Semesterwochenstunde") per teaching method**	**Hours in semester per teaching method** 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	**Workload in hours** sum contact hours and self-study in hrs.	**ECTS (credit points)** generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	2 (2)	30 (30)		
	Übung / Exercise & Seminar	1 (1)	15 (15)		
	Praktikum / Lab course	2 (0)	30 (0)		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5 (3)	Sum contact hours in hrs. 75 (45)		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3 (3)*	45 (45)	**180 (90)**	**6 (3)**
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*4 (0)*	60 (0)		
	Sum	**7 (3)**	Sum self-study in hrs 105 (45)		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Students will be familiar with concepts and reaction/transport and energy generation/storage mechanisms relevant in bioinorganic chemistry. They develop knowledge about structure and function of most important metals and metal enzymes. Moreover, they will be able to select and apply analytical methods to determine the structure and to characterize the function of metal containing molecules which occur in biochemical processes.

5.2 Course content

Lecture:
Overview on metal ions and bioinorganic compounds, e.g. metal porphyrine complexes, in living systems, energy sources of life, metals in photosynthesis and in the respiratory chain, oxygen transport and storage, electron transfer, nitrogen assimilation, biochemistry of iron, biochemistry of non-metals, diagnostic and therapeutic use of metal complexes, toxicology of metals, biochemistry of NO
Seminar:
Each student will present a hot topic, i.e. a recent original paper, in bioinorganic chemistry.
Lab course:

Students will investigate the kinetics of an enzyme in presence / absence of different inhibitors; a lab report has to be submitted.
→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelor degree in chemistry, chemical engineering, or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Proof of a seminar presentation (30 minutes), accepted report of the successful lab work, and pass the exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Written tasks and / or oral presentations on practical experiments.
Written exam (180 minutes) or oral exam.

6.4 Requirements for admission to examination
Enrollment in the program, registration for examination (via myFH-Portal)
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal).

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr. Thomas Jüstel

7.3 Professors (optional)
Prof. Dr. Thomas Jüstel, Prof. Dr. Thomas Schupp

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Literature:
1. Lecture Notes (at web-page of the department and at ILIAS)
2. Structural and Functional Aspects of Metal Sites in Biology in Chem. Reviews 96 (1996) 2239
3. Inorganic Chemistry: Principles of Structure and Reactivity, James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Okhil K. Medhi, Walter de Gruyter, 2006
4. N. Metzler-Nolte, U. Schatzschneider, Bioinorganic Chemistry: A Practical Course, Walter de Gruyter, 2009
5. D. Rabinovich, Bioinorganic Chemistry, Walter de Gruyter, 2020

1	**1.1 Title of module (GER / ENG)** Chemical Engineering – CAE Project Tools	**1.2 Short description (optional)** CAE	**1.3 Module code** (from HIS-POS) **CIW.2.0074.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 Workload

				Workload in total	
	Teaching methods	**Weekly teaching hours ("Semesterwochenstunde") per teaching method**	**Hours in semester per teaching method** 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	**Workload in hours** sum contact hours and self-study in hrs.	**ECTS (credit points)** generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	0	0	**90**	**3**
	Seminar	1	15		
	Praktikum / Lab course	2	30		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 3	Sum contact hours in hrs. 45		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor- und Nachbereitung der Projektarbeit, Poster/Präsentation	*3*	45		
	Sum	**3**	Sum self-study in hrs 45		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

This module CAE Project Tools is a condensed but authoritative course for chemical engineering that focuses on the principles and practical skills needed to solve real-world problems. With an emphasis on a pragmatic approach, the module delivers key content in a practical format and presents topics important to tomorrow's chemical engineer: Engineering, equipment procurement, legal considerations, the need for oral and written communication skills, and Incoterms (International Commercial Terms) for practicing engineers.

You will plan process engineering processes at the basic engineering level, submit process engineering design and drawings (as required: 2D, isometric view) and present parts lists of requested components and evaluate them technically and commercially. In the team phase (project), you will coordinate your learning activity as well as your team skills independently to prepare and submit project documentation on time and in a professional manner.

5.2 Course content

Fast planning and construction projects have become an essential economic success factor in the chemical industry. In this elective module, you will learn how to work with plant models (COMOS) and one project each for dimensioning process engineering plants (one model each).

Model examples:
- Distillation column(s) with auxiliary apparatus,

- Absorption column for chemical sorption with auxiliary equipment (e.g. CO_2 capture),
- Evaporation plant with thermo-siphon,
- spray drying, etc.

In the seminar, you will work on a topic area of plant planning (e.g. risk analysis, BGR 104, TRBS, pressure loss calculation), cost calculation, Incoterms (International Commercial Terms) and document your results in the form of an organised project folder.

Project work: Within the module, modelling of heat transfer, pressure loss and phase equilibria is worked on and explained in a project-oriented manner in a team, as required.
Digitalisation of plants and dimensioning is carried out via COMOS. Integrated plant management over the entire life cycle - from engineering to operation. The "COMOS Process" module is of interest because it contains the P&ID applications.
→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Chemical Engineer (Process Engineering) B.Sc. and matriculation Chemical Engineering

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Passing the COMOS intermediate examination and recognition of academic achievements (successful participation in the project and preparation of the project documentation), through proof and notification to the examination office.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
COMOS intermediate examination and structured project documentation (project description, part liste, heat-& massflow, effluents and DRAFT CE STATEMENT) or oral examination.

6.4 Requirements for admission to examination
Enrolment and timely online registration the university portal within the enrolment period and positive COMOS intermediate examination.

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr.-Ing. Andreas Wäsche

7.3 Professors (optional)
Prof. Dr.-Ing. Andreas Wäsche, Lehrbeauftragter Raffael Schwarz M.Sc.

7.4 Maximum number of participants (optional)
20

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Chemical Engineering: The Essential Reference | McGraw-Hill Education - Access Engineering (accessengineeringlibrary.com) (2014);
Perry's Chemical Engineers' Handbook | McGraw-Hill Education - Access Engineering (accessengineeringlibrary.com). (2019)
VDI 6600 Project Ingenieur, DIN EN ISO 12100, DIN ISO 10628_R&I, 2006-42-EG_maschinenrichtlinie_de

1	**1.1 Title of module (GER / ENG)** Chemical Sensors	**1.2 Short description (optional)** CS	**1.3 Module code** (from HIS-POS) **CIW.2.0055.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Materials Science and Engineering	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3*	45		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*2*	30		
	Prüfungsvorbereitung	*2*	30		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

After attending this course students can describe the basic components, methods and functions of chemical sensors. They can explain the electrochemical and spectroscopic techniques used in chemical sensing and can allocate their typical applications. They can apply the most important parameters for the qualitative evaluation of analytical-chemical measurement systems. Students can reproduce the structure and modes of operation of chemically-sensitive materials, realise the impact of materials science on sensor development and are able to assess solutions to specific analytical questions. On the basis of exercises the students will review their learning progress, discuss examples from the literature and compare different methods.

By attending the lab course students apply their learned skills regarding design and fabrication of sensor materials, measurement methods and data evaluation.

5.2 Course content

- Basic components of chemical sensors: recognition elements, signal transduction and processing
- Quality evaluation of analytical measurements, data evaluation and statistics
- Electrochemical Sensors: Measurement techniques and set ups, selective electrodes and applications
- Optical Sensors: Spectroscopic methods, instrumentation, molecular probes, sensor materials and application examples
- Acoustic and mass sensors
- Sensors with biochemical recognition elements (biosensors)
- Challenges and future applications
- Project-oriented lab course

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in chemistry, chemical engineering, physics or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Pass the exam, attested lab course, active participation in exercises.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Written exam (120 minutes) or oral exam (45 min).

6.4 Requirements for admission to examination

Enrollment in the module, registration for examination (via myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**

☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr. Michael Schäferling

7.3 Professors (optional)

Prof. Dr. Michael Schäferling

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Script

Jiri Janata, Principles of Chemical Sensors, Springer 2009

1	**1.1 Title of module (GER / ENG)** Chemistry for Engineers	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0060.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Materials Science and Engineering	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	2	30	**90**	**3**
	Übung / Exercise	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 3	Sum contact hours in hrs. 45		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*2*	30		
	Prüfungsvorbereitung	*1*	15		
	Sum	**3**	Sum self-study in hrs 45		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Students should be able to handle the basic concepts and working methods of inorganic and organic chemistry. At appropriate points, cross-references to materials science or biochemistry will be demonstrated.

5.2 Course content

<u>Inorganic chemistry</u>

Units of measurement, ideal gas, energy conversion in chemical processes, application of the law of mass action, atomic structure and chemical bonds, periodic table, oxidation and reduction, acids and bases

<u>Organic chemistry</u>

Chemistry of carbon, bond types, hybridization, valence bond model of chemical bonding, electronegativity, dipole moment and formal charges of organic molecules, reactivity, nucleophilicity, electrophilicity, functional groups as ordering principle of organic chemistry, mesomerism, tautomerism, aromaticity, electron distribution in organic compounds, introduction to the nomenclature of simple organic molecules, formula notation, presentation of reaction mechanisms: substitution, addition, elimination reactions of alkenes, alcohols and carbonic acids and esters (including polymerization)

→ details can be found in course syllabus, recommended study plan etc.

	5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.
6	**6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)* Bachelor degree in chemistry, chemical engineering, physics or closely related.
	6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation) Pass the exam
	6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes) Written exam (90 minutes) or oral exam (30 min).
	6.4 Requirements for admission to examination Enrollment in the module, registration for examination (via myFH-Portal).
	6.5 Weighing of module grade when calculating final grade see examination regulations for aforementioned study programmes (line 3).* *You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.
7	**7.1 Languages used in the module:** ☐**German** ☒ **English** ☐ **others, namely:**
	7.2 Contact person for module: Prof. Dr. Thomas Jüstel
	7.3 Professors (optional) Prof. Dr. Thomas Schupp
	7.4 Maximum number of participants (optional)
	7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.) Literature: Textbooks on fundamentals of general, inorganic and organic chemistry Manuscript for download at ILIAS platform

1	**1.1 Title of module (GER / ENG)** Computational Fluid Dynamics	**1.2 Short description (optional)** CFD	**1.3 Module code** (from HIS-POS) **CIW.2.0018.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	2	30	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	3	45		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3*	45		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**6**	Sum self-study in hrs 90		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Students know the basic equations of fluid mechanics and the difficulty in solving them analytically. Students know how an approximate solution with a Computational Fluid Dynamics Program can be achieved. Different discretisation schemes are known. Furthermore, the accuracy of the solution can be evaluated and different turbulence models and their use are known.

5.2 Course content

Firstly, mathematical and physical basics are discussed to be able to explain the deduction of the basic equations of fluid mechanics. It is reviewed why the Navier-Stokes-Equations cannot easily be solved analytically, thus, experimental and numerical methods have to be used to find a solution to different flow problems. Different discretisation schemes are explained (space and time) which are the first steps of a numerical solution. Furthermore, the importance of boundary conditions and their impact on the flow problem are shown as well as the accuracy of a numerical solution. The technical term of turbulence is explained and the necessity of the use of turbulence models in Computational Fluid Dynamics. Moreover, incompressible flows, time-dependent flows, flows with heat transfer and multiphase flows will be discussed.

In different tutorial courses the use of a commercial CFD program for different flow problems is practiced as well as the discussion, description and presentation of numerical solutions.

Furthermore, a group assignment has to be done. Each group simulates a different fluid mechanical problem, including the geometry and meshing.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in Chemical Engineering, Chemistry or closely related

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Presentation of the assignment and oral exam.
Praktikumsnachweis (schriftlicher Bericht) und Bestehen der Prüfung.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Oral presentations on practical experiments and subsequent oral exam.
The assignment report is marked and weights 50% of the overall mark.

6.4 Requirements for admission to examination

Regular participation in lab exercises and the assignment and recognition of the associated report
Enrolment in the programme, register for the examination (via myFH-Portal).
Regelmäßige Teilnahme am Praktikum und Anerkennung der zugehörigen Ausarbeitungen.
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr.-Ing. Mirjam Altendorfner

7.3 Professors (optional)

Prof. Dr.-Ing. Mirjam Altendorfner

7.4 Maximum number of participants (optional)

20

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Manuscript.
Recommendations are given in the lecture.

1	**1.1 Title of module (GER / ENG)** Electrochemistry - Basics and analytical applications	**1.2 Short description (optional)** EC	**1.3 Module code** (from HIS-POS) **CIW.2.0070.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Materials Science and Engineering	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	2 (2)	30 (30)	**180 (90)**	**6 (3)**
	Übung / Exercise	1 (1)	15 (15)		
	Praktikum / Lab course	2 (0)	30 (0)		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5 (3)	Sum contact hours in hrs. 75(45)		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3 (3)*	45 (45)		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*4 (0)*	60 (0)		
	Sum	**7 (3)**	Sum self-study in hrs 105 (45)		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Students know about with the basic theoretical concepts of electrochemistry. They have gained a profound knowledge about electroanalytical chemistry.
They are familiar with the structure and instrumentation of electrochemical cells and are able to carry out and evaluate common electrochemical analysis methods.

5.2 Course content

Fundamentals of the electrode processes (electrode processes, faradaic and non-faradaic processes, Butler-Volmer equation, Tafel straight line, overvoltage)

Instrumentation (electrochemical cells, working counter and reference electrodes, diffusion and liquid junction potentials, microelectrodes)

Conductometry (ionic conductivities, transfer numbers)

Potentiometry (Nernst's equation, activities, membrane potential, ion-selective electrodes)

Coulometry (potentiostatic and amperostatic mode of operation, coulometric titration, gravimetry)

Amperometry (single potential amperometry, step response amperometry, Chronoamperometry, ampererometric titration)

Voltammetry (electrode types, current/voltage curve, polarography, linear and pulsed voltammetry, stripping voltammetry, cyclic voltammetry, hydrodynamic methods, study of reaction mechanisms, spectroelectrochemistry).

Lab
During the laboratory course, the students work on current tasks from the laboratory or work on their own topics after consultation.
Students write an experimental protocol and present their results in the form of an oral presentation.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.
Analytical electrochemistry plays a crucial role in scientific research, industry, and various technological applications. They link electrical variables such as current or voltage with chemical parameters.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelor degree in chemistry, chemical engineering, or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Written report on laboratory experiments, oral presentation of the results and successful examination.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Written exam (120 minutes) or oral exam (30-45 min).

6.4 Requirements for admission to examination
Enrollment in the programme, registration for examination (via myFH-Portal)
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal)

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr. Klaus Schlitter

7.3 Professors (optional)
Prof. Dr. Klaus Schlitter

7.4 Maximum number of participants (optional)
10 (only for lab course)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Literature: Lecture manuscript, literature will be announced in the lecture.

1	**1.1 Title of module (GER / ENG)** Incoherent Light Sources	**1.2 Short description (optional)** ILS	**1.3 Module code** (from HIS-POS) **CIW.2.0029.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering	WPf	2.
	M.Sc. Materials Science and Engineering	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.
	Master Großer Wahlbereich TECST	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	2	30		
	Praktikum / Lab course				
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen, Übungen und Seminar Preparation and revision of lectures, exercises and seminar	7	105		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students will know the physical concepts of light generation and the technical realization of these concepts as practical light sources. Moreover, they will learn the application areas of light sources also beyond illumination and about the design of luminaires and information displays.
Students will be able to select light sources and proper materials with respect to the application area aimed at.

5.2 Course content

History of light sources, radiometric and photometric quantities, perception of light, color coordinates, color temperature, and color rendering, additive and subtractive color mixing, physical concepts of light generation, incandescent and halogen lamps, low-pressure discharge lamps (Hg and Na), high-pressure discharge lamp (Hg, Na, metal halide, Xe), Luminescent materials, mechanisms of luminescence, Inorganic LEDs, OLEDs and PLEDs, gas discharge displays, UV radiation sources.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in chemistry, chemical engineering, physics, physical engineering, mechanical or electrical engineering

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Proof of a seminar presentation and pass the exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Written exam (180 minutes) or oral exam.

6.4 Requirements for admission to examination

Enrollment in the program, registration for examination (via myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**

☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr. Thomas Jüstel

7.3 Professors (optional)

Prof. Dr. Thomas Jüstel, Prof. Dr. Joachim Breternitz

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

1. Scriptum, online @ www.fh-muenster.de/juestel and at ILIAS
2. K.H. Butler, Fluorescent Lamp Phosphors, University Park, PA (1980)
3. A.H. Kitai, Solid State Luminescence, Chapman & Hall, London (1993)
4. G. Blasse, B.C. Grabmeier, Luminescent Materials, Springer Verlag Berlin Heidelberg (1994)
5. W. Schmidt, Optische Spektroskopie, VCH (1995)
6. J.R. Coaton, A.M. Marsden, Lamps and Lighting, Arnold, London (1997)
7. D.R. Vij, Luminescence of Solids, Plenum Press, New York and London (1998)
8. S. Shinoya, W.M. Yen, Phosphor Handbook, CRC Press (1999)
9. Zukauskas, M.S. Shur, R. Caska, Introduction to Solid-State Lighting, John Wiley & Sons, Inc. (2002)
10. E.F. Schubert, Light Emitting Diodes, Cambridge Univ. Press (2003)
11. C.R. Ronda, Luminescence, Wiley-VCH (2008)
12. R. Pöttgen, T. Jüstel, C. Strassert, Rare Earth Chemistry, De Gruyter (2020)

1	**1.1 Title of module (GER / ENG)** Management Methods	**1.2 Short description (optional)** MM	**1.3 Module code** (from HIS-POS) **CIW.2.0033.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Gruppenarbeit / Teamwork	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*4*	60		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

After successful completion of this module, students will be able to:

- Identify and select suitable management methods for typical challenges in process engineering contexts.
- Apply appropriate management methods to real-world engineering and organizational problems in a structured and goal-oriented way.
- Develop in-depth expertise in at least one management method, including its theoretical foundation, practical application, strengths, and limitations.
- Demonstrate an overview of relevant management methods from the perspective of a process engineer, with an understanding of when and why each method is used.
- Critically evaluate management methods regarding their applicability, efficiency, and limitations in industrial environments.

5.2 Course content

This course provides an introduction to management methods (MM) with a specific focus on their application in process engineering. It begins with an overview of the role and importance of management methods in engineering contexts. A brief theoretical foundation introduces key principles such as systems thinking, process orientation, and fundamental concepts of decision-making, with a clear emphasis on supporting practical application.
The course focuses on management methods relevant to process engineers, including approaches for risk assessment, project management, strategy development, decision-making, KPI development, leadership, and so on.
A strong emphasis is placed on practical application through case studies and real-world examples from process engineering. Students apply selected methods to typical industrial problems and develop deeper expertise in one chosen method, including its theoretical background, practical implementation, and critical evaluation.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in chemistry, chemical engineering, or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Presentation, written or oral exam.

6.4 Requirements for admission to examination

Enrollment in the module, registration for examination (via myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**

☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr.-Ing. Moritz Venschott

7.3 Professors (optional)

Prof. Dr.-Ing. Moritz Venschott, Lehrbeauftragte Katrine Heijne

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Literatur: Wird in der Vorlesung bekannt gegeben

1	1.1 Title of module (GER / ENG)	1.2 Short description (optional)	1.3 Module code (from HIS-POS)
	Membrane Separations	MS	**CIW.2.0034.0.M***
2	2.1 Cycle of module: ☒ each summer semester, ☐ each winter semester other cycle, namely:	2.2 Duration of module ☒ 1 semester ☐ 2 semesters	
3	3.1 Module offered in the following study programme(s):	3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)	3.3 Recommended semester:
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Materials Science and Engineering	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method (1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks)	Workload in total: Workload in hours (sum contact hours and self-study in hrs.)	Workload in total: ECTS (credit points) (generally 30 hrs. = 1 credit point; only full numbers allowed)
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	2	30		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3*	45		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**6**	Sum self-study in hrs 90		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

The students are able to model mass transfer in membrane processes. They can decide about the right type of membrane module and membrane material and they can design membrane processes for typical separation tasks in chemical and biotechnological processes.

After completion of the lab training they can design experiments for the characterization of membranes and membrane modules.

5.2 Course content

Introduction to membrane technology:
Rejection, selectivity, flux, driving forces, membranes and their characterisation

Mass transfer:
Mass transfer in porous and non-porous membranes, concentration polarization, fouling and scaling, gel-permeation model, osmotic pressure model

Pressure driven membrane separations for liquid mixtures with liquid products:
Microfiltration, Ultrafiltration, Nanofiltration, Reverse Osmosis

Permeation of gases and vapours:
Gas permeation, vapour permeation, pervaporation

Membrane separations driven by concentration difference:
Dialysis, membrane contactors

Membrane separations driven by an electrical field

Lab: Experimental tasks with respect to membrane characterization and membrane production
→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelor degree in chemistry, chemical engineering, or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Accepted lab report and pass the exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Written exam (120 minutes) or oral exam.

6.4 Requirements for admission to examination
Enrollment in the programme, registration for examination (via myFH-Portal)
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal)

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

7.3 Professors (optional)

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Literature:
Seader, Henley: Separation Process Principles, Wiley, 1998
Mulder: Basic Principles of Membrane Technology, Kluwer, 1996
Strathmann, H.: Introduction to Membrane Science and Technology, Wiley-VCH, 2011
Melin, T., Rautenbach, R.: Membranverfahren, Springer, 2003
Baker, R.W.: Membrane Technology and Applications, Wiley, 2012

1	**1.1 Title of module (GER / ENG)** Petroleum Refining Technology	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0040.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 4	Sum contact hours in hrs. 60		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*8*	120		
	Sum	**8**	Sum self-study in hrs 120		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Students will be able to have knowledge in composition, properties and classification of crude oil or petroleum. Familiar with operations and processes in petroleum processing as well related chemistry and catalysis. Knowledgeable about impurities in crude oil and how to remove them from products. Develop understanding of refinery products and their specifications. Develop understanding of safety and environmental issues in petroleum refining.

5.2 Course content

Introduction to the Petroleum Industry: History and origin and occurrence of crude oil, composition and classification of crude oil and petroleum refinery products, typical fraction cuts and boiling ranges for atmospheric and vacuum still fractions. Chemistry and catalysis of upgrading processes, Chemistry and catalysis of hydrotreating reactions for sulfur and nitrogen removal, develop understanding acids gas removal, sulfur recovery, waste water treatment in refinery.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in chemistry, chemical engineering, or closely related.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Proof of a seminar presentation (30 minutes) and pass the exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Written tasks and / or oral presentations on practical experiments.
Exam (180 minutes) or oral exam.

6.4 Requirements for admission to examination

Regular participation in lab exercises and recognition of the associated report.
Enrollment in the programme, registration for examination (via MyFH-Portal).
Regelmäßige Teilnahme am Praktikum und Anerkennung der zugehörigen Ausarbeitungen.
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über MyFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**

☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr.-Ing. Mirjam Altendorfner

7.3 Professors (optional)

Lehrbeauftragter Tristan Börger

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

1. R.A. Meyers, ‘Handbook of Petroleum Refining Processes”, 3rd Ed. McGraw-Hill, 2004.
2. J.H. Gary and G. E. Handwerk “Petroleum Refining Technology and Economics”, 4th Ed. Marcel Dekker, Inc., 2001.
3. J.G. Speight, “The Chemistry and Technology of Petroleum”, 4th Ed. CRC Press, 2007.
4. M.R. Murray, “Upgrading Petroleum Residues and Heavy Oils”, M. Dekker, 1994.
5. James G. Speight, Baki Ozum “Petroleum Refining Processes” M. Dekker, 2002.
6. W. L. Nelson “Petroleum refinery engineering” McGraw-Hill, 1958 - Technology & Engineering.

1	**1.1 Title of module (GER / ENG)** Process Design	**1.2 Short description (optional)** PD	**1.3 Module code** (from HIS-POS) **CIW.2.0041.0.M**
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	2	30		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 6	Sum contact hours in hrs. 90		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3*	45		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**6**	Sum self-study in hrs 90		

5 5.1 Intended learning outcomes (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

This module enables students to independently apply their knowledge from Chemical Reaction Engineering and Unit Operations to perform complete process synthesis for industrially relevant design problems. Students will use process simulators to balance processes, size equipment, and evaluate investment and operating costs, ensuring efficient and responsible production.
They will critically evaluate alternative design solutions, considering engineering feasibility, operational efficiency, and sustainability, promoting sustainable industrial practices.

- Upon completion, students will be able to:
- Independently perform process design, simulation, and cost evaluation.
- Make informed design decisions that integrate sustainability, safety, and efficiency.
- Critically reflect on different design alternatives and trade-offs between engineering, operation, and maintenance.
- Contribute to responsible chemical production and industrial innovation, aligned with global sustainability goals.

The module fosters autonomous problem-solving and responsible engineering judgment, preparing graduates to design efficient, sustainable, and socially responsible chemical processes.

5.2 Course content

The module covers the complete design of a chemical process, beginning with the collection of product specifications and process data and the development of a process flowsheet. It includes process synthesis, establishment of mass and energy balances, and definition of stream conditions, supported by simplified process models to represent unit operations. Heat and power integration is considered to enhance efficiency and promote responsible resource use.
The workflow encompasses equipment design and sizing, estimation of capital and operating costs, and assessment of the economic and environmental impact of the process. The design process integrates principles of safety, controllability, and sustainability, with attention to resource efficiency, pollution reduction, and circular production practices. Optimization techniques are applied to refine the process, balancing technical feasibility, economic viability, and environmental responsibility.
Overall, the module emphasizes innovative and sustainable chemical process design, preparing graduates to contribute to efficient, socially responsible, and environmentally conscious industrial practices aligned with global sustainability goals.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Bachelor degree in Chemical Engineering or similar course programme with knowledge in Chemical Process Technology and Chemical Reaction Engineering.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Accepted lab report and passing the exam.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Written reports and / or oral presentations on practical experiments.
Portfolio, written (120 minutes) or oral exam.

6.4 Requirements for admission to examination

Enrollment in the programme, registration for examination (via myFH-Portal).
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal).

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**

☐**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prof. Dr.-Ing. Moritz Venschott

7.3 Professors (optional)

Prof. Dr.-Ing. Moritz Venschott, Prof. Dr.-Ing. Andreas Wäsche

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

Literature: Lecture materials as a PDF
Seider, Seader, Lewin – Process Design Principles, Wiley, 1999;
Ullmann´s Encyclopedia of Industrial Chemistry, VCH, 1992;

Process Development, Chemical Plant Design and Construction, Production-Integrated Environmental protection;
Blass, Entwicklung verfahrenstechnischer Prozesse, 2. Auflage, Springer 1997
Smith, R.; Chemical Process Design and Integration, Wiley, 2005

1	1.1 Title of module (GER / ENG)	1.2 Short description (optional)	1.3 Module code (from HIS-POS)
	Science Slam und Wissenschaftskommunikation		**CIW.2.0064.0.M***
2	2.1 Cycle of module: ☒ each summer semester, ☐ each winter semester other cycle, namely:	2.2 Duration of module ☒ 1 semester ☐ 2 semesters	
3	3.1 Module offered in the following study programme(s):	3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)	3.3 Recommended semester:
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Materials Science and Engineering	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.
	Master Großer Wahlbereich TECST	WPf	2.

4 Workload

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method (1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks)	Workload in total: Workload in hours (sum contact hours and self-study in hrs.)	Workload in total: ECTS (credit points) (generally 30 hrs. = 1 credit point; only full numbers allowed)
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Seminar / Seminar (Präsenz)	2	30	**90**	**3**
	Übung / Exercise	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 3	Sum contact hours in hrs. 45		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*3*	45		
	Sum	**3**	Sum self-study in hrs 45		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

- Studierende sind in der Lage, wissenschaftliche Themen faktisch korrekt und kritisch aufzuarbeiten.
- Studierende haben einen Überblick über verschiedene Methoden der Wissenschaftskommunikation.
- Studierende haben Kenntnisse über verschiedene Präsentationstechniken.
- Studierende probieren sich in der kreativen Aufarbeitung einzelner Fragestellungen.
- Studierende können verschiedene Stilmittel (z. B. Rhetorik, Gestik usw.) gezielt einsetzen.
- Die klare Herausarbeitung konkreter Ziele oder Fragestellung stellt kein Problem für die Studierenden dar.

5.2 Course content

a) Einführung in den Science Slam:
Was ist Science Slam? Wo kommt Science Slam her? Was sind die Ziele von Science Slams?

b) Wissenschaftskommunikation:
Was ist Wissenschaftskommunikation? Wofür brauchen wir Wissenschaftskommunikation? Wer macht Wissenschaftskommunikation?

c) Präsentationstechnik
Auf welche Methoden kann ich in der Präsentation eines bestimmten Themas zurückgreifen?

d) Recherche
Wie genau muss ich ein Thema beherrschen um Wissenschaftskommunkation zu betreiben?

e) Science Slam
Erstellen eines eigenen Science Slam

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
0.5 – 1 DIN A4 Motivationsschreiben: Warum möchte ich dieses Modul belegen?

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Teilnahme an (> 80%) des Seminartermine, Bestehen der Prüfung.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Präsentation eines eigenen Science Slam + schriftliche Ausarbeitung (70%).
Teilnahme an der Diskussion im Seminar und den Hausaufgaben (30%).

6.4 Requirements for admission to examination
Teilnahme an (> 80%) des Seminartermine

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☐ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr.-Ing. Samir Salameh

7.3 Professors (optional)
Prof. Dr.-Ing. Samir Salameh

7.4 Maximum number of participants (optional)
10

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Alles Nötige wird in der Vorlesung besprochen.

Anwesenheitspflicht
Dieses Modul erlaubt nur 10 Studierende und findet erst ab einer Mindestanzahl von 5 Studierenden statt.

1	**1.1 Title of module (GER / ENG)** Spektreninterpretation	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0044.0.M**
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	WPf	2.
	M.Sc. Chemical Engineering – Chemical Processing	WPf	2.
	M.Sc. Materials Science and Engineering	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Praktikum / Lab course	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 5	Sum contact hours in hrs. 75		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*4*	60		
	Vor- und Nachbereitung der Praktikumsversuche Preparation and review of laboratory experiments	*3*	45		
	Sum	**7**	Sum self-study in hrs 105		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Die Studierenden sind in der Lage, Strukturaufklärungen von Substanzen anhand von 1H-NMR,13C-NMR, Massenspektren, IR-Spektren und UV-Spektren durchzuführen.

5.2 Course content

Das Modul ist spezielles Thema der Instrumentellen Analytik.

1H-NMR / 13C-NMR
Grundlegende Aspekte dieser Methode, die unmittelbaren Einfluss auf das Spektrum nehmen.
Zusammenhang Struktur und Spektrum
IR
Grundlegende Aspekte dieser Methode, die unmittelbaren Einfluss auf das Spektrum nehmen.
Zusammenhang Struktur und Spektrum
UV
Grundlegende Aspekte dieser Methode, die unmittelbaren Einfluss auf das Spektrum nehmen.
Zusammenhang Struktur und Spektrum

MS
Grundlegende Aspekte dieser Methode, die unmittelbaren Einfluss auf das Spektrum nehmen.
Zusammenhang Struktur und Spektrum

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*
Bachelorabschluss in Chemie oder Chemieingenieurwesen oder ähnlicher Fachrichtung mit Grundlagenkenntnissen der Instrumentellen Analytik I und II (vgl. B.Sc.Chemieingenieurwesen)

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)
Praktikumsnachweis und Bestehen der Prüfung.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)
Klausur (180 Minuten) oder mündliche Prüfung.

6.4 Requirements for admission to examination
Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung (über myFH-Portal)

6.5 Weighing of module grade when calculating final grade
see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☐ **English** ☐ **others, namely:**

7.2 Contact person for module:
Prof. Dr. Martin Kreyenschmidt

7.3 Professors (optional)
Prof. Dr. Martin Kreyenschmidt

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)
Skript

1	**1.1 Title of module (GER / ENG)** Wasseraufbereitung – Technische und chemische Methoden	**1.2 Short description (optional)** WaTech	**1.3 Module code** (from HIS-POS) **CIW.2.0069.0.M***
2	**2.1 Cycle of module:** ☒ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering	WPf	2.
	M.Sc. Material Science and Engineering	WPf	2.
	M.Sc. Wirtschaftsingenieurwesen	WPf	2.
	Master Großer Wahlbereich TECST	WPf	2.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)	Vorlesung /Lectures	3	45	**180**	**6**
	Übung / Exercise	1	15		
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden") 4	Sum contact hours in hrs. 60		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Vor und Nachbereitung der Vorlesungen und Übungen Preparation and revision of lectures and exercises	*6*	90		
	Prüfungsvorbereitung Preparation for examination	*2*	30		
	Sum	**8**	Sum self-study in hrs 120		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Das Modul behandelt zunächst die Herkunft und physikochemischen Eigenschaften des Lösungsmittels Wasser sowie dessen Bedeutung sowohl für die Biochemie als auch für die technische Chemie und Lebensmittelerzeugung. Es umfasst daneben die Bereiche der Aufbereitung und Desinfektion von Rohwässer, z.B. Uferfiltrat, Brunnen- oder Oberflächenwasser. Es werden verfahrenstechnische und chemische Maßnahmen zum Schutz der Trink- und Prozesswasserqualität behandelt. Dazu zählen beispielsweise Prozesse der Sedimentation, Filtration, Fällung, Ozonierung und Desinfektion mit UV-Strahlung oder chemischen Reagenzien.
Das Problem klimatisch bedingter Wasserknappheit und der damit einhergehenden Reduktion der Wasserqualität durch Änderung der Wassertemperatur wird thematisiert. Die Veranstaltung schließt mit technischen Methoden zur Erzeugung von Ozon, Wasserstoffperoxid und UV-C Strahlung.
Die Studierenden kennen die Prozesse und Verfahren zur Aufbereitung von Trinkwasser sowie Ab- und Prozesswasser. Sie sind in der Lage Anlagen zur Wasseraufbereitung zu bewerten. Abhängig von der Zusammensetzung des Rohwassers können geeignete Verfahren zur Trinkwasseraufbereitung ausgewählt werden. Insbesondere können die Studierenden entscheiden, welche chemischen oder photochemischen bzw. elektrochemischen Verfahren zur Desinfektion und/oder Reinigung von Trink-, Prozess-, sowie

Abwasser eingesetzt werden müssen. Zudem sind Anlagen zur Ozonbildung und Strahlungsquellen bekannt, die entweder direkt oder in Kombination mit weiteren Reagenzien der Wasserchemie Verwendung finden.

5.2 Course content

Wasser – Allgemeine Grundlagen
Historie der Wasseraufbereitung, Hydrosphäre der Erde, Wasservorkommen, Bedeutung und Nutzung, physikalische Eigenschaften, elutrope Reihe, Chemie des Wassers, Wasserstoff und Sauerstoff, chemische und mikrobiologische Verunreinigungen, Mikro- und Nanoplastik

Technische Wasseraufbereitung
Überblick der Reinigungsmethoden, Biologische Methoden und Sauerstoffbedarf, Filtration, Sedimentation, Fällungsmethoden, Flokkulation

Chemische Methoden der Wasseraufbereitung
Fällungsreaktionen, Phosphatfällung, Enteisenung, Entmanganung, Chlorierung, Ozonbildung und Ozonierung, weitere Desinfektions- und Oxidationsmittel

Photochemische Methoden der Wasseraufbereitung
Biochemische Grundlagen der Keimzahlreduktion, GAC-Kurve, Erzeugung und Anwendung von UV-Strahlung, photokatalytische Verfahren zur Reinigung, Photolyse von Mikroschadstoffen, (photochemische) Verfahren zur Ozon- und Peroxidbildung, Mikroplastikabbau

Elektrochemische Methoden der Wasseraufbereitung
Elektrochlorierung, elektrochemische Erzeugung von Oxidations- und Desinfektionsmitteln, elektrochemische Wasserenthärtung, Elektrodialyse, Elektrodeionisierung, elektrochemische Dehalogenierung, elektrochemische Oxidation organischer Mikroschadstoffe, elektrochemische Metallabscheidung, Elektroflotation und -flokkulation.

Wasser als technisches Medium
Betrieblicher Einsatz von Wasser zum: Heizen, Kühlen (direkt, indirekt), Reinigen, Luftbefeuchten, Verdünnen, Extrahieren, Injizieren, Dampferzeugung und Eisherstellung oder als R-718 in wärmegetriebenen Sorptionskältemaschinen.
Technische Begriffe (WFI-Wasser, Kühlturmwasser, Heizdampf, Speisewasser, Dampf- u. Brüdenkondensate, Zentrate und Filtrate, Extrakte, Lutterwasser, Wasser als natürliche Wärmequelle) werden erläutert. Diagramm nach Mollier, Sorptionsisothermen für Trockenlebensmittel, Verderbsmöglichkeiten als Funktion der Wasseraktivität, Phasendiagramm Wasser (Sublimation, Vakuumverdampfung, Schmelzen, System: Verdampfen-Brüdenkompression, h|s Diagram, log (p)|h Diagramm.

Virtuelles Wasser
Methoden zur Ermittlung von Wasserverbräuchen bei der Herstellung von Produkten. Dabei wird zwischen blauem, grünem und grauem Wasser differenziert. Forschungsstand zur Wasserwiederverwendung (UBA), Festlegung der Schlussfolgerungen zu den besten verfügbaren Techniken (BVT) gemäß der Richtlinie 2010/75/EU.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

Das Modul betrifft Verfahren zur Ab-, Prozess-, und Trinkwasseraufbereitung. Diese sind ein wichtiger Baustein zur Sicherung der Trinkwasserversorgung sowie der Prozesswasseraufbereitung in vielen Industriezweigen, wobei die Komplexität der Verfahren durch den Klimawandel zunimmt.

6	**6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)* Formal: Immatrikulation Inhaltlich: Grundkenntnisse in anorganischer, organischer und physikalischer Chemie sowie Physik
	6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation) Bestehen der Prüfung und Anerkennung der Studienleistungen (erfolgreiche Teilnahme am seminaristischen Projekt inkl. Anfertigung eines Berichts)
	6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes) Klausur (120 min) oder mündliche Prüfung.
	6.4 Requirements for admission to examination Immatrikulation und fristgerechte Online-Anmeldung über das myFH-Portal innerhalb des Anmeldezeitraums.
	6.5 Weighing of module grade when calculating final grade see examination regulations for aforementioned study programmes (line 3).* *You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.
7	**7.1 Languages used in the module:** ☒**German** ☒ **English** ☐ **others, namely:**
	7.2 Contact person for module: Prof. Dr. Thomas Jüstel
	7.3 Professors (optional) Prof. Dr. Thomas Jüstel, Prof. Dr.-Ing. Andreas Wäsche, N.N.
	7.4 Maximum number of participants (optional)
	7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.) Vorlesungsskripte sowie weitere Literatur wird über ILIAS zur Verfügung gestellt.

Übersicht Wahlpflichtkatalog 2 / Overview of compulsory elective catalog 2

WS 2026/27

FB	Modul	Modulnummer	Sprache	Verantwortlich
MB	Höhere FEM	MB.2.0022	Deutsch	Prof. Finke
MB	Höhere Strömungsmaschinen	MB.2.0025	Deutsch	Prof. Annas
MB	Nachwachsende Rohstoffe	MB.2.0045	Deutsch	Prof. J. Scholz
ETI	Fortgeschrittene Regelungstechnik	ETI.2.0113	Deutsch	Prof. Bodenburg
PHY	Technische Biomechanik 1	PHY.2.0111	Deutsch	Herr Prof. Peikenkamp
PHY	Quantum Statistical Physics	PHY.2.0131	Englisch	Herr Prof. Morawetz
PHY	Arbeits- und Gesundheitsschutz	PHY.2.0117	Deutsch	Herr Prof. Backhaus
PHY	Solid State Physics and Seminconductors	PHY.2.0145	Englisch	Herr Prof. Mertins
PHY	Photonic Crystals and Materials	PHY.2.0144	Englisch	Herr Prof. Vogelbacher
PHY	Laser Physics	PHY.2.0059	Englisch	Herr Prof. Gurevich
CIW	Applied Process Development	CIW.2.0065.0	Englisch	Herr Prof. Salameh
ITB	Digital Ecosystems	ITB.2. 0196	Deutsch	Prof. Hemker
ITB	Kommunikationstraining für angehende Führungskräfte	ITB.2.0065.0.	Deutsch	Prof. Alonso
ITB	Social Entrepreneurship	ITB.2.0179	Deutsch	Prof. Böckermann
ITB	Management im Wandel	ITB.2.0206	Deutsch	Prof. Striewe
ITB	Business Ethics	ITB.2.0190	Deutsch	Dr. Michel-Fabian
ITB	AI Augmented Engineering	ITB.2.0xxx	Deutsch	Prof. Ziegenbein Prof Hemker
EGU	Wasser- und Windkraftnutzung	EGU.2.0160.0.	Deutsch	Herr Prof. Vennemann
EGU	Wasserstoffanwendungen in der Praxis	EGU.2.0161.0.	Deutsch	Frau Prof. Möller
EGU	Biomassenutzung	EGU.2.0158.0.	Deutsch	Herr Prof. Brügging
EGU	Netzmanagement	EGU.2.xxx	Deutsch	Herr Prof. Rolink

Abschlussmodule / Final modules

1	**1.1 Title of module (GER / ENG)** Masterarbeit / Masterthesis	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0001.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	Pf	4.
	M.Sc. Chemical Engineering – Chemical Processing	Pf	4.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total Workload in hours sum contact hours and self-study in hrs.	Workload in total ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)				**810**	**27**
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden")	Sum contact hours in hrs.		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Selbstständige Bearbeitung eines wissenschaftlichen Themas Self-guided treatment of a scientific subject	*54*	810		
	Sum	**54**	Sum self-study in hrs 810		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Die Absolventen können innerhalb einer vorgegebenen Frist ein Thema aus dem Fachgebiet in ihren fachlichen Einzelheiten als auch in den fachübergreifenden Zusammenhängen nach wissenschaftlichen und fachpraktischen Methoden selbstständig bearbeiten. Sie können das Erarbeitete ansprechend und wissenschaftlich korrekt schriftlich darstellen.

The graduates can work on a topic independently within a specified period of time. They are able to develop solutions for a problem based on their knowledge and expertise in chemical engineering as well as on their understanding of the interdisciplinary contexts and practical methods. They are able to present their compiled results clearly, understandable and plausible in written form.

5.2 Course content

Die Abschlussarbeit ist eine schriftliche Ausarbeitung. Der Richtwert für den Umfang des Textteils der Masterarbeit beträgt 60 Seiten DIN A4 (mit ca. 2000 Zeichen je Seite).

Die Bearbeitungszeit (Zeitraum von der Ausgabe bis zur Abgabe) der Masterarbeit beträgt bis zu fünf Monate. Eine Fristverlängerung ist gemäß § 19 Absatz 3 AT PO auf Antrag möglich.

Der Antrag auf Zulassung zur Masterarbeit ist mit entsprechendem Formular schriftlich an den Prüfungsausschuss zu richten und dem Prüfungsamt vor Beginn der Masterarbeit vorzulegen, das entsprechende Zulassungsschreiben geht Ihnen umgehend zu.
The thesis is a written report. The benchmark for the length of the text part of the thesis is 60 pages DIN A4.

The processing time (time from registration of the subject to submission) of the thesis is up to five months.

The application for admission to the Master's thesis must be sent with the appropriate form in writing to the examination committee and submitted to the examination office before the start of the Master's thesis, the corresponding letter of admission will be sent in response.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal:* examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Zur Masterarbeit kann zugelassen werden, wer alle Modulprüfungen bis auf eine Modulprüfung bestanden und drei Projektarbeiten erfolgreich abgeschlossen hat.

The student is accepted for the Master thesis when he has passed all exams (except one module) and has successfully completed three projects.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

Bericht - Auswertung und Dokumentation der Masterarbeit.
Report - Evaluation and documentation of the master thesis.

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Anwendungs- oder forschungsorientierte, selbstständige Bearbeitung eines wissenschaftlichen Themas (Dauer max. 5 Monate).
Masterarbeit (ca. 60 Seiten DIN A4 mit ca. 2000 Zeichen je Seite).
Die Abschlussarbeit wird gemäß ATPO von zwei Prüfenden bewertet.

Application or theory oriented, independent work on a scientific problem (maximum duration 5 month).
Masterthesis (Report about 60 A4 pages with about 2000 characters per page)
The thesis is evaluated by two examiners.

6.4 Requirements for admission to examination

Einschreibung im Studiengang, fristgerechte Anmeldung zur Masterarbeit im Prüfungsamt.
Enrollment in the programme, register for the masterthesis at examination-office.

https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Antrag_auf_Zulassung_zur_Abschlussarbeit_26.06.2024.pdf
https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Antrag_auf_Zulassung_zur_Abschlussarbeit_27.06.2024_englisch.pdf

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prüfungsausschussvorsitzender
Chairman of the examination board

7.3 Professors (optional)

Dozenten FH Münster
Lecturers / Professors of the University of Applied Sciences Münster

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)

1	**1.1 Title of module (GER / ENG)** Kolloquium	**1.2 Short description (optional)**	**1.3 Module code** (from HIS-POS) **CIW.2.0030.0.M***
2	**2.1 Cycle of module:** ☐ **each summer semester,** ☐ **each winter semester** **other cycle, namely:**	**2.2 Duration of module** ☒ **1 semester** ☐ **2 semesters**	
3	**3.1 Module offered in the following study programme(s):**	**3.2 Compulsory (Pf), compulsory elective (WPf), elective (W)**	**3.3 Recommended semester:**
	M.Sc. Chemical Engineering – Applied Chemistry	Pf	4.
	M.Sc. Chemical Engineering – Chemical Processing	Pf	4.

4 **Workload**

	Teaching methods	Weekly teaching hours ("Semesterwochenstunde") per teaching method	Hours in semester per teaching method 1 weekly teaching hour per semester can be indicated as 15 hours, i.e. 1 weekly teaching hour = 1 hour x 15 semester weeks	Workload in total: Workload in hours sum contact hours and self-study in hrs.	Workload in total: ECTS (credit points) generally 30 hrs. = 1 credit point; only full numbers allowed
Contact hours (e.g. lecture, seminar, practical course, practical phase/internship, group work, project work, case study, simulation game, credited tutorial (addtional lines possible)				**90**	**3**
	Sums	Sum contact hours in weekly teaching hours ("Semesterwochenstunden")	Sum contact hours in hrs.		
Self-study (e.g. tutorial, preparation, follow-up work, preparation for assignments and homeworks, research etc.)	Präsentation und Verteidigung der Masterarbeit Presentation and defense of master thesis	*6*	90		
	Sum	**6**	Sum self-study in hrs 90		

5 **5.1 Intended learning outcomes** (What should students be able to do after having accomplished the module? (professional knowledge and soft skills))

Die Absolventen sind in der Lage, die Ergebnisse ihrer Abschlussarbeit, ihre fachlichen Grundlagen und ihre fächerübergreifenden Zusammenhänge und außerfachlichen Bezüge mündlich darzustellen. Sie können die Bedeutung ihrer Ergebnisse für die Wissenschaft und/oder Praxis selbstständig begründen und einschätzen und sich einer Diskussion vor fachkundigem Publikum stellen.

The graduates will be able to orally present the results of their thesis, the technical foundations and its interdisciplinary relationships. The graduates can justify the importance of their results for science and/or practice and they are able to defend the results in a scientific discussion.

5.2 Course content

Das Kolloquium ergänzt die Masterarbeit und ist eigenständig zu bewerten. Das Kolloquium dient der Feststellung, ob die Kandidatin oder der Kandidat befähigt ist, die Ergebnisse der Abschlussarbeit, ihre fachlichen Grundlagen, ihre fächerübergreifenden Zusammenhänge und ihre außerfachlichen Bezüge mündlich darzustellen und selbstständig zu begründen und ihre Bedeutung für die Wissenschaft und/oder Praxis einzuschätzen. Dabei soll auch die Bearbeitung des Themas der Abschlussarbeit mit der Kandidatin oder dem Kandidaten erörtert werden.
Der Antrag auf Zulassung ist eine Woche vor dem Prüfungstermin schriftlich auf entsprechendem Formblatt an den Prüfungsausschuss zu richten.
Das Kolloquium wird als Präsentation mit anschließender mündlicher Prüfung durchgeführt und dauert insgesamt ca. 30 bis 60 Minuten.

The colloquium supplements the Master's thesis and is to be assessed independently. The colloquium serves to determine whether the candidate is able to orally present and independently justify the results of the thesis, its subject-specific foundations, its interdisciplinary connections and its extracurricular references and to assess its significance for science and/or practice. The candidate should also discuss the topic of the thesis with the candidate.

The application for admission should be sent one week before the examination date in writing on the appropriate form to the Examination Committee.
The colloquium will be conducted as a presentation followed by oral examination and takes about 30 to 60 minutes.

→ details can be found in course syllabus, recommended study plan etc.

5.3 Short information about module (This paragraph [max. 250 characters] will be published on the website of FH Münster to support persons interested in studying at FH Münster to choose the appropriate study programme. Please focus on the main intended learning outcomes and course content, ideally also comprising information about the relevance of the module for the further course of study and the labour market. Please formulate whole sentences, address your (prospective) students directly and avoid technical terms.

6 **6.1 Prerequisits** (*formal*: examination of module XY has to be passed or similar *content-wise*; *module XY should have been attended, the following knowledge and skills should have been acquired: ….)*

Zum Kolloquium kann zugelassen werden, wer die Voraussetzungen für die Zulassung zur Masterarbeit nachgewiesen hat und diese mit mindestens "ausreichend" (4,0) bewertet wurde und alle Modulprüfungen und 3 Projektarbeiten bestanden hat.

To the final colloquium can be admitted who´s Master thesis is marked at least "satisfactory" (4.0) and who has passed all module examinations and as well as the project module.

6.2 Requirements for awarding credit points (e.g. passing final examination, successful accomplishment of assignments in the course of study, regular active participation)

mündliche Präsentation / oral presentation

6.3 Type and extent of examination (e.g. written exam, oral exam, term paper, presentation, portfolio, duration of examination in minutes)

Präsentation / mündliche Prüfung (30 bis 60 Minuten). Das Kolloquium wird als mündliche Prüfung durchgeführt. Das Kolloquium wird von den die Abschlussarbeit prüfenden Personen gemeinsam abgenommen und bewertet.

Presentation / oral examination (30 to 60 minutes). The colloquium will be conducted as an oral examination. The colloquium is evaluated by the examiners of the thesis.

6.4 Requirements for admission to examination

Einschreibung im Studiengang, fristgerechte Anmeldung zur Prüfung im Prüfungsamt.
Enrollment in the programme, registration for examination at exam office.

https://www.fh-muenster.de/ciw/downloads/ciw-a-z/Anmeldung_auf_Zulassung_zum_Kolloquium_CIW_V3.pdf

6.5 Weighing of module grade when calculating final grade

see examination regulations for aforementioned study programmes (line 3).*

*You will find the examination regulations of all study programmes in the official announcements of the FH Münster: https://www.fh-muenster.de/hochschule/aktuelles/amtliche_bekanntmachungen/index.php?p=2,7.

7 **7.1 Languages used in the module:**
☒**German** ☒ **English** ☐ **others, namely:**

7.2 Contact person for module:

Prüfungsausschussvorsitzender
Chairman of the examination board

7.3 Professors (optional)

Dozenten FH Münster
Lecturers / Professors of the University of Applied Sciences Münster

7.4 Maximum number of participants (optional)

7.5 Further information (optional) (e.g. literature recommendations, other persons involved, etc.)