UNIVERSITÄT SIEGEN

Chemistry Department

Master of Science, M. Sc.

HANDBOOK OF MODULES

for

Chemistry

Solid State Chemistry

Siegen, July 2009

General preliminary remarks

Brief description of the course of studies
The consecutive Master study programme is designed to enable students to directly change over to a chemistry-oriented occupational field or to begin the doctorate programme in chemistry on the basis of an in-depth scientific education. In particular, students are to acquaint themselves with modern theoretical and experimental developments in the field of study in its entire breadth and moreover be enabled to develop strategies for solving complex issues individually and in teams and to act with scientific and social responsibility. Variable specialization and prioritization in this Degree programme is to allow students to put together an individual educational profile for themselves in the course of the Master study programme.

The Master study programme provides in-depth natural scientific education with specific regard to main research topics in chemistry and adjacent areas of Universität Siegen. During the first semester, advanced theoretical and methodical skills in the core subjects and in two application-oriented minor fields of study (applied chemistry) are imparted. In these courses, perspectives for specialization in the respective subject are highlighted and the basis for academic development is created. From the second semester onward, deepening of knowledge in compulsory optional modules takes place. In the fourth semester, the Master's dissertation/thesis is written in the subject of specialization. Deepening of knowledge can take place in more research-oriented subjects and is then geared to current research topics of the faculty. As a rule, this deepening of knowledge is aimed at the Master's degree as the qualification for subsequent doctorate. Then again, there is the possibility of deepening one's knowledge in the more application-oriented subjects in order to directly enter into work life upon having obtained the Master's degree.

Prioritization in the compulsory optional field and specialization practicals comprise the following areas of research and education:

– Chemistry: Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Analytical Chemistry, Chemistry of Building Materials and Materials, Macromolecular Chemistry.
– Non-chemical disciplines: Biology, Computer Science, Didactics, esp. Didactics of Chemistry, Economic Disciplines, Electrical Engineering, Foreign Language and Communication, Mathematics, Mechanical Engineering, Physics.

The spectrum of the compulsory optional subject I is consistent with the classic subjects of inorganic chemistry, organic chemistry and physical chemistry. In addition to these subjects, one of the application-oriented subjects of analytical chemistry, construction and materials chemistry or macromolecular chemistry can be chosen as compulsory optional subject II. Compulsory optional subjects I and II must not be the same to prevent focusing too much on one subject. After all, the compulsory optional subject III comprises the entire range of the above mentioned chemical and non-chemical subjects. The modules "Lab course: Research project" must be consistent with the compulsory optional subject I and/or II.

The language of instruction in all chemical subjects is English unless otherwise stated in the module descriptions.

Table 1 shows the course schedule of the Master study programme for chemistry. This module overview lists the titles/short titles of modules, the distribution of hours to the type of knowledge transfer (lecture, tutorial, seminar, lab course) as well as the credit points (CP) associated with them followed by the module descriptions in the individual chemistry courses (order: 1. all courses during the first semester; 2. compulsory optional courses sorted by subjects; 3. Master's dissertation/thesis).

In compulsory optional subject III, all modules can be chosen, which are offered in the study programmes of the faculties of electrical engineering, informatics, mechanical engineering, mathematics, physics, economics or in the "Kompetenzzentrum der Universität Siegen" (KoSi). Module descriptions for courses recommended for students of chemistry as compulsory optional subject III are outlined separately in annex 1.

Basically, all modules are marked. As a rule, written examinations are designated as final module examination or partial module examination. For marking, however, the following assessment methods can also be used: a) final oral module examinations or b) partial oral module examinations, c) seminar presentations, d) written assignments, e) marked lab-course performance. Designated assessment methods are specified in the relevant module descriptions. Students must expressly be notified of any deviations from the details contained in the module descriptions by the responsible lecturer at the beginning of the course, i.e. during the first lecture week.

Computation of the workload is based on attendance time (1 HPW = 60 minutes over 15 weeks per semester), preparation and revision times as well as preparations for examinations. Total hours of work of 30 h per semester equals 1 KP. For granting ECTS points, the conversion factor recommended by the GDCh (German Chemical Society's) commission of experts was used (rounded to 0.5 KP in each case):

Lectures, tutorials, seminars: 1.5 x HPW = KP (except for foreign languages)
Lab course (1st semester): 0.75 x HPW = KP
Lab course (2nd semester): 0.65 x HPW = KP
Lab course (3rd semester): 0.85 x HPW = KP

Prerequisites for examination
Participation in examinations in a chosen module is not linked with any special prerequisites unless explicitly stated in the module description.

Export of teaching
The modules of the Master study programme for chemistry are suited as compulsory subject or compulsory optional subject in the following courses: course for a teaching degree in chemistry (GHR (primary school, secondary general school, intermediate secondary school) and GYM (grammar school)), Master study programme in physics, mechanical engineering, engineering sciences.
Integration of the chemistry modules into the curriculum of the respective courses can be taken from the relevant examination regulations. For additional information, please refer to:
http://www.uni-siegen.de/uni/studium/?lang=de
https://lsf.zv.uni-siegen.de/qisserver/rds?state=user&type=0&application=QISLSF.

Responsibility for the modules
Due to foreseeable fluctuations in the personnel structure of the Faculty of Chemistry – Biology of Universität Siegen, several responsible instructors have been listed for some modules. In addition, the Board of Examiners appointed by the Faculty Committee is responsible for correct implementation of the module descriptions.

Module Structure of the Master Studies in Chemistry

	Module	L / HPW[a]	T,S / HPW[a]	LC / HPW[a]	Σ HPW	KP
1. Sem.						
7.1	Inorganic Chemistry	2	2		4	6
7.2	Organic Chemistry	2	2		4	6
7.3	Physical Chemistry	2	2		4	6
7.4	Applied Chemistry I[b]	2		4	6	6
7.5	Applied Chemistry II[b]	2		4	6	6
Sum		**10**	**6**	**8**	**24**	**30**
2. Sem.						
8.1	Compulsory optional subject I[c]	2	2		4	6
8.2	Compulsory optional subject II[d]	2	2		4	6
8.3	Compulsory optional subject III[e]	2	2		4	6
8.4	Lab course in compulsory optional subject I			7	7	4
8.5	Lab course in compulsory optional subject II			7	7	4
8.6	Foreign language	2	2		4	3
Sum		**8**	**8**	**14**	**30**	**29**
3. Sem.						
9.1	Compulsory optional subject I	2	2		4	6
9.2	Compulsory optional subject II	2	2		4	6
9.3	Compulsory optional subject III	2	2		4	6
9.4	Lab course: Research project I[f]			7	7	7
9.5	Lab course: Research project II[f]			7	7	6
Sum		**6**	**6**	**14**	**26**	**31**
4. Sem.						
10.1	Master Thesis (6 months)					**30**

[a] L = lecture; T/S = tutorial or seminar; LC = lab course, HPW = Hours per week of confrontation time in one semester. Factors for the determination of credit points (KP): L/E/S 1.5 x HPW (except for Foreign langauge); P (1. Sem.) 0.75 x HPW; P (2. Sem.) 0.65 x HPW; P (3. Sem.) 0.85 x HPW; rounded to 1 KP, resp. [b] Applied Chemistry I and II:, Analytical Chemistry, Chemistry of Building Materials and Materials, Macromolecular Chemistry (Applied Chemistry I and Applied Chemistry II need to cover different topics). [c] Compulsory optional subject I: Inorganic Chemistry, Organic Chemistry, Physical Chemistry. [d] Compulsory optional subject II (cannot be identical with compulsory optional subject I): Inorganic Chemistry, Analytical Chemistry, Chemistry of Building Materials and Materials, Macromolecular Chemistry, Organic Chemistry, Physical Chemistry. [e] Compulsory optional subject III: Biology, Computer Science, Didactics, esp. Didactics of Chemistry, Economic Disciplines, Electrical Engineering, Foreign Language and Communication, Mathematics, Mechanical Engineering, Physics, Inorganic Chemistry, Analytical Chemistry, Chemistry of Building Materials and Materials, Didactics, Macromolecular Chemistry, Organic Chemistry, Physical Chemistry. [f] Lab courses: Research project I and II need to be consistent with compulsory optional subjects I and/or II.

Module Description

Degree programme	**Master *Chemistry***
Course title	**Compulsory optional subject I / II, Inorganic Chemistry**
Subtitle (optional)	Solid State Chemistry
Responsible lecturer	Dr. Adlung, Prof. Dr. Engelen
Teaching type	Lecture, tutorial
Relation to curriculum	Chemistry, elective
Semester	2
Credit points (KP)	6
Workload	Lecture: 30 h, tutorial: 30 h, additional individual work of the student / homework time: 120 h
Prerequisites for participation	B.Sc. Chemistry (or accepted equivalent)
Learning outcomes / Competences	The students are able to recognize and evaluate advanced concepts of the chemistry of solid compounds. They are able to judge and discuss in oral and written form the most important classes of materials and types of crystal structures, the bonding in solids, the importance of crystallography for the understanding of solids, important physical investigation methods and crystal growth processes.
Course description	L: Structure types and methods of chemical synthesis and crystal growth, chemical and physical properties of solids, classes of materials: insulators, semiconductors and metals; superconductors, ionic conductors, dielectric, magnetic and optic materials, advanced aspects of crystallography, models of chemical bonding in the solid, structure analysis based on single crystals and powders, electron microscopy. T/S: Computer oriented presentation and communication of selected topics .
Interdisciplinary qualifications	Application of advanced knowledge and skills in inter- and trans-disciplinary discussion of complex issues, debating and discussing in a foreign language
Prerequisites for examination	Regular participation at tutorial
Assessment method (Contribution)	Written final examination (75%), marked assignments (25%), written final examination need to be passed.
Literature	Lecture, tutorial, seminar**:** Shriver, Atkins, *Inorganic Chemistry*; West, *Basic Solid State Chemistry*, U. Mueller, *Inorganic Structural Chemistry*

Module Description

Degree programme	**Master *Chemistry***
Course title	**Lab course: Compulsory optional subject I / II, Inorganic Chemistry**
Subtitle (optional)	Advanced Inorganic Laboratory Course in small groups
Responsible lecturer	Dr. Adlung, Dr. Neumann, Prof. Dr. Wickleder
Teaching type	Lab course
Relation to curriculum	Chemistry, elective
Semester	2
Credit points (KP)	4
Workload	Lab course: 105 h, additional individual work of the student / homework time: 15 h
Prerequisites for participation	B.Sc. Chemistry (or accepted equivalent)
Learning outcomes / Competences	The students are able to plan and execute selected preparation methods for inorganic solids. They master important characterization methods for inorganic solids and they are able to interpret, to classify and to compare measurement results. They are able to summarize a research topic in written form according to scientific standards.
Course description	LC: Special preparation techniques and analytical methods for inorganic solids. Use of important program systems and data bases in inorganic solid state chemistry.
Interdisciplinary qualifications	Organization and management of a scientific project, ability to work in an international (and intercultural) team, presentation of the results of a scientific investigation to an expert audience, communication and presentation skills, debating and discussing in a foreign language
Prerequisites for examination	Participation at the lab course
Assessment method (Contribution)	Experimental skills, planning/organization of experiments, lab report (33.3%, resp.)
Literature	Original literature, special literature, special data bases.